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TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN (INTERMEDIATE AND DEPOT)

CRYOGENIC SERVICE SYSTEM, LIQUID OXYGEN A/F26A-2
PART NUMBER 160021-1

CRYOGENIC SERVICE SYSTEM, LIQUID NITROGEN A/F26A-1
PART NUMBER 160021-3

CRYOGENIC STORAGE TANK ASSEMBLY, LIQUID OXYGEN TMU-79/F
PART NUMBER 160001-1

CRYOGENIC STORAGE TANK ASSEMBLY, LIQUID NITROGEN TMU-86/F
PART NUMBER 160001-3

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NUMERICAL LIST OF EFFECTIVE WORK PACKAGES

List of Current Changes

Original 0 . . . . . 1 April 1983
Change 1 . . . . . 30 March 1986

Only those work packages assigned to the manual are listed in this index. Insert Change 1, dated 30 March 1986. *Dispose of superseded work packages.* If changed pages are issued to a work package, insert the changed pages in the applicable work package. The portion of text affected in a changed or revised work package is indicated by change bars or the change symbol R in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands or change bars, as applicable.

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

ALPHABETICAL INDEX

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 001 00, dated 1 April 1983

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

NUMERICAL INDEX OF PART NUMBERS

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 001 01, dated 1 April 1983

PART NUMBER	WP/FIG/INDEX NO.	PART NUMBER	WP/FIG/INDEX NO.
A18-6	010 00/3/11	B26002030	009 00/1/33
A43-20	010 00/3/6	B33507502	009 00/1/26
A472000	010 00/3/5	B492-8BN	011 00/2/3
AN365-624	013 00/3/15	C-116420	011 00/4/5
AN6-56A	013 00/3/13	C-116420	011 00/6/5
AN816-8-8J	009 00/1/139	C0720-055-0880-S	013 00/3/45
AN818-8J	009 00/1/141	C7525-8A	010 00/3/3
AN824-8J	009 00/1/144	C8991180	008 00/1/68
AN827-10J	009 00/1/145	CR151020112	009 00/1/61
AN904-8J	009 00/1/138	D-25031	011 00/6/2
AN919-12J	009 00/1/146	D-61959	011 00/3/11
AN924-8J	009 00/1/147	D-61959	011 00/6/15
AN929-8J	009 00/1/153	D-61962	011 00/6/15
AN960-616	008 00/1/128	D-65939	011 00/4/12
AN960-616	008 00/1/60	D-65994	011 00/4/12
AN960-616	013 00/3/14	E-25278	011 00/3/2
AN960-816	008 00/1/109	E-26375	011 00/6/2
AN960-816	008 00/1/155	E-35209	011 00/4/11
AN960-816	008 00/1/26	E-40270	011 00/6/6
AN960-816	008 00/1/39	E-40272	011 00/3/6
AN960-816	008 00/1/48	E-40272	011 00/6/6
AN960-816	008 00/1/63	E-40275	011 00/4/6
AN960-816	008 00/1/85	E-40275	011 00/6/6
AN960-816	013 00/3/24	E-5151	011 00/4/2
APR568-016	013 00/3/48	E-61957	011 00/6/15
APR568-020	013 00/3/50	E-62238	011 00/6/14
B260020	009 00/1/31	E-63067	011 00/3/7
B26002020	009 00/1/36	E-64238	011 00/6/12

PART NUMBER	WP/FIG/INDEX NO.
E-66380	011 00/4/10
E-66388	011 00/4/9
E-66392	011 00/6/7
E-66890	011 00/6/7
EYS21	009 00/1/5
F-24748	011 00/3/5
F-29983	011 00/6/4
F-29986	011 00/4/4
F-33916	011 00/6/3
F-33918	011 00/3/3
F-33918	011 00/6/3
F-33919	011 00/4/3
F-40286	011 00/3/9
F-40286	011 00/6/13
F-40289	011 00/6/13
F-40291	011 00/6/10
F-40293	011 00/6/10
F-40296	011 00/6/10
F-40298	011 00/6/11
F-40300	011 00/6/11
F-40303	011 00/6/11
F-5148	011 00/6/2
F-62233	011 00/6/14
F-62235	011 00/3/10
F-62235	011 00/6/14
F-62429	011 00/6/13
F-63065	011 00/6/7
F-63070	011 00/3/8
F-63230	011 00/6/3
F-63232	011 00/6/4
F-63605	011 00/3/4
F-63605	011 00/6/4
F-64233	011 00/6/12
F-64235	011 00/6/12
F-66382	011 00/6/8
F-66384	011 00/6/8
F-66385	011 00/4/7
F-66584	011 00/6/8
F-8653	011 00/3/1
F-8653	011 00/4/1
F-8653	011 00/6/1
FA2286-1L	009 00/1/30
FA2305-36	009 00/1/25
FA2306-4	009 00/1/27
FA2321-1B0	009 00/1/34
FA2321-1R0	009 00/1/37
M2T/BRASS + P4 = (3)B1	008 00/1/98
M70CR616-12	013 00/3/22
MS16631-225	013 00/3/10
MS20822-4-4J	009 00/1/143
MS20822-8-8J	009 00/1/148
MS21209-C6-15	013 00/3/21
MS21209-C8-20	013 00/3/16
MS21318-21	007 00/1/9
MS21318-21	008 00/1/140
MS21318-21	009 00/1/158
MS21318-21	009 00/1/42
MS24584-24	008 00/1/10
MS24584-24	008 00/1/8
MS24584-55	008 00/1/103
MS24584-55	008 00/1/18
MS24584-57	008 00/1/15
MS24584-59	008 00/1/104
MS24617-20	010 00/3/2
MS24629-45	008 00/1/22
MS24693-C7B	013 00/3/6
MS25082-B20	010 00/3/7
MS35223-32	009 00/1/53
MS35223-32	009 00/1/62
MS35223-32	009 00/1/67
MS35223-34	009 00/1/74
MS35224-66	009 00/1/55
MS35224-66	009 00/1/58
MS35224-66	009 00/1/64
MS35233-12	008 00/1/78
MS35234-71	009 00/1/89
MS35307-306	009 00/1/85
MS35307-363	008 00/1/70
MS35307-417	008 00/1/24
MS35307-417	008 00/1/37
MS35307-417	008 00/1/46
MS35307-417	008 00/1/61
MS35307-419	008 00/1/153
MS353307-417	008 00/1/107
MS353307-418	008 00/1/122
MS35333-37	009 00/1/68
MS35333-39	009 00/1/56
MS35333-39	009 00/1/59
MS35333-39	009 00/1/65
MS35338-138	009 00/1/91
MS35338-139	009 00/1/100
MS35338-139	009 00/1/104
MS35338-139	009 00/1/96
MS35338-43	008 00/1/105
MS35338-44	007 00/1/15
MS35338-44	007 00/1/21
MS35338-44	008 00/1/42
MS35338-44	008 00/1/51
MS35338-44	008 00/1/82

PART NUMBER	WP/FIG/INDEX NO.
MS35338-44	009 00/1/77
MS35338-44	009 00/1/86
MS35338-46	008 00/1/29
MS35338-46	008 00/1/72
MS35338-48	007 00/1/4
MS35338-48	008 00/1/124
MS35338-50	009 00/1/23
MS35649-2252	009 00/1/76
MS35650-302	008 00/1/16
MS35650-302	008 00/1/19
MS35650-304	009 00/1/90
MS45904-76	010 00/3/8
MS51967-14	007 00/1/3
MS51967-14	008 00/1/123
MS51967-14	008 00/1/154
MS51967-14	008 00/1/84
MS51967-14	009 00/1/127
MS51967-2	007 00/1/14
MS51967-2	007 00/1/20
MS51967-2	008 00/1/41
MS51967-2	008 00/1/50
MS51967-2	008 00/1/81
MS51967-20	009 00/1/22
MS51967-23	009 00/1/82
MS51967-8	008 00/1/108
MS51967-8	008 00/1/25
MS51967-8	008 00/1/28
MS51967-8	008 00/1/38
MS51967-8	008 00/1/47
MS51967-8	008 00/1/59
MS51967-8	008 00/1/62
MS51967-8	008 00/1/71
MS51971-1	009 00/1/103
MS51971-1	009 00/1/95
MS51971-1	009 00/1/99
MS90725-113	007 00/1/2
MS90725-113	013 00/3/25
MS90725-114	009 00/1/126
MS90725-163	009 00/1/21
MS90725-87	009 00/1/124
N002270	010 00/3/19
N5000-106H	013 00/3/43
N5008-75H	013 00/3/44
P1X1 1/8	009 00/1/121
P90A-184T	012 00/1
P90A-184T-21	012 00/1/4
P90A-184T-22	012 00/1/3
P90A-184T-23	012 00/1/6
P90A-184T-25	012 00/1/20
P90A-184T-26	012 00/1/21

PART NUMBER	WP/FIG/INDEX NO.
P90A-184T-26	012 00/1/5
P90A-184T-29	012 00/1/22
P90A-184T-30	012 00/1/7
P90A-184T-32	012 00/1/24
P90A-184T-33	012 00/1/25
P90A-184T-35	012 00/1/19
P90A-184T-35A	012 00/1/18
P90A-184T-36	012 00/1/17
P90A-184T-37	012 00/1/16
P90A-184T-38	012 00/1/15
P90A-184T-39	012 00/1/1
P90A-184T-40	012 00/1/2
P90A-184T-41	012 00/1/23
P90A-184T-45	012 00/1/14
P90A-184T-46	012 00/1/11
P90A-184T-47	012 00/1/8
P90A-184T-48	012 00/1/9
P90A-184T-49	012 00/1/10
P90A-184T-50	012 00/1/12
P90A-184T-51	012 00/1/13
Q1X1 1/4	009 00/1/122
RC20GF2222K	010 00/3/14
RC32GF5R6K	010 00/3/15
T-217	009 00/1/6
TL-800-B	008 00/1/9
UA 1/2	009 00/1/19
UA-2-1-3000	008 00/1/33
US 3/4	009 00/1/20
V-75	009 00/1/45
V911	009 00/1/43
VXHA119	009 00/1/44
000813	011 00/8/8
000823	011 00/8/11
000839	011 00/8/9
002258	011 00/8/15
002286	011 00/8/16
002374	011 00/8/1
002491	011 00/8/10
002504	011 00/8/12
002577	011 00/8/3
002626	011 00/8/14
002677	011 00/8/7
10-4RTX-B	009 00/1/150
10-FNTX-B	008 00/1/114
10-FTX-B	008 00/1/112
10423B	011 00/5/6
10446B	011 00/5/4
10447B	011 00/5/2
10449B	011 00/5/7
1044B	011 00/5/3

PART NUMBER	WP/FIG/INDEX NO.
10992	011 00/7/2
10993	011 00/7/8
10BTX-B	009 00/1/140
10GTX-B	009 00/1/151
12001	011 00/7/3
12002	011 00/7/12
12003	011 00/7/11
12094	011 00/7/9
12533	011 00/7/17
13399	011 00/7/16
141	009 00/1/10
141	009 00/1/47
142	009 00/1/11
142	009 00/1/24
142	009 00/1/29
142	009 00/1/32
142	009 00/1/35
1500	010 00/3/4
160001-1	007 00/1/5
160001-1	008 00/1
160001-3	007 00/1/6
160001-3	008 00/1
160001-P102	008 00/1/125
160001-P59	008 00/1/101
160001-P60	008 00/1/2
160001-P61	008 00/1/110
160001-P80	008 00/1/127
160003-1	008 00/1/131
160003-11	008 00/1/144
160003-13	008 00/1/139
160003-13	008 00/1/146
160003-15	008 00/1/147
160003-17	008 00/1/149
160003-19	008 00/1/148
160003-21	008 00/1/145
160003-23	008 00/1/138
160003-25	008 00/1/132
160003-27	008 00/1/134
160003-29	008 00/1/133
160003-31	008 00/1/150
160003-33	008 00/1/135
160003-35	008 00/1/136
160003-37	008 00/1/152
160003-5	008 00/1/141
160003-5	008 00/1/151
160003-7	008 00/1/142
160003-9	008 00/1/143
160004-1	008 00/1/117
160005-1	008 00/1/121
160005-3	008 00/1/23
160005-5	008 00/1/36
160005-7	008 00/1/126
160006-1	008 00/1/57
160006-13	008 00/1/90
160006-15	008 00/1/91
160006-17	008 00/1/92
160006-19	008 00/1/93
160006-21	008 00/1/94
160006-3	008 00/1/45
160006-5	008 00/1/79
160007-1	008 00/1/6
160007-11	008 00/1/56
160007-13	008 00/1/35
160007-15	008 00/1/69
160007-19	008 00/1/73
160007-21	008 00/1/11
160007-23	008 00/1/12
160007-25	008 00/1/13
160007-27	008 00/1/88
160007-29	007 00/1/16
160007-29	007 00/1/23
160007-3	008 00/1/7
160007-31	007 00/1/24
160007-33	008 00/1/89
160007-35	008 00/1/102
160007-5	008 00/1/20
160007-6	008 00/1/21
160007-7	008 00/1/14
160007-9	008 00/1/44
160007-P24	008 00/1/74
160007-P25	008 00/1/75
160007-P29	008 00/1/76
160007-P34	008 00/1/77
160013-1	007 00/1/8
160013-3	007 00/1/7
160016-1	007 00/1/12
160016-3	007 00/1/18
160021-3	007 00/1
160041-1	007 00/1/1
160041-1	009 00/1
160041-P69	009 00/1/154
160041-P70	009 00/1/155
160041-P71	009 00/1/156
160042-1	009 00/1
160042-P8	009 00/1/7
160042-P9	009 00/1/8
160045-1	009 00/1
160045-P2	009 00/1/75
160045-P21	009 00/1/70
160045-P22	009 00/1/69

PART NUMBER	WP/FIG/INDEX NO.
160045-P32	009 00/1/48
160045-P37	009 00/1/78
160046-1	009 00/1/80
160047-1	009 00/1/83
160048-11	009 00/1/88
160048-13	009 00/1/101
160048-15	009 00/1/93
160048-17	009 00/1/97
160048-3	009 00/1/81
160048-7	009 00/1/84
160049-1	009 00/1/105
160049-13	009 00/1/110
160049-15	009 00/1/111
160049-17	009 00/1/112
160049-19	009 00/1/113
160049-21	009 00/1/114
160049-23	009 00/1/92
160049-25	009 00/1/115
160049-27	009 00/1/116
160049-29	009 00/1/117
160049-3	009 00/1/106
160049-5	009 00/1/107
160049-7	009 00/1/108
160049-9	009 00/1/109
160053-1	009 00/1/40
160053-11	009 00/1/159
160053-13	009 00/1/160
160053-15	009 00/1/161
160053-17	009 00/1/162
160053-19	009 00/1/163
160053-21	009 00/1/164
160053-23	007 00/1/10
160053-25	007 00/1/11
160053-3	009 00/1/41
160053-5	009 00/1/38
160053-7	009 00/1/39
160053-9	009 00/1/157
16021-1	007 00/1
162	009 00/1/168
176	010 00/3/20
180007-1	009 00/1/2
180110-13	008 00/1/106
180444-1	008 00/1/118
180459-25	008 00/1/87
1872	008 00/1/86
1872	009 00/1/87
1872	011 00/3
190026-1	009 00/1/54
190039-7	009 00/1/63
190105-1	008 00/1/34
190256-5	009 00/1/57
190282-1	009 00/1/1
190302-15	009 00/1/60
190302-17	009 00/1
190332-1	009 00/1/52
190350-1	009 00/1/72
190351-1	009 00/1/73
190357-1	009 00/1/3
190369-1	009 00/1/66
190386-9	009 00/1/51
190403-3	009 00/1/50
190404-1	009 00/1/71
190405	008 00/1/96
190406-1	008 00/1/99
190406-1	011 00/1
190409-1	009 00/1/136
190410-1	009 00/1/137
190411-1	009 00/1/123
190412-1	009 00/1
190413-1	009 00/1/28
190414-1	009 00/1
190415-1	009 00/1
190416-1	009 00/1
190417-1	009 00/1
190418-1	008 00/1/31
190418-3	008 00/1/55
190418-3	009 00/1/133
190418-5	008 00/1/66
190420-1	008 00/1/157
190420-3	008 00/1/156
1F18186	009 00/1/79
20DU1Z	013 00/3/3
2163	011 00/7/10
2200901-1	008 00/1/97
2200901-1	010 00/3
2200901-3	010 00/3/1
2200902-1	008 00/1/100
2259B-1MM	013 00/3/39
2300217-3	013 00/3/56
2300227-1	013 00/3/58
2300229-1	013 00/3/29
2300233-5	013 00/3/26
2300245-1	013 00/3/40
2300253-1	013 00/3/28
2304510-1	013 00/3/52
2304511-1	013 00/3/54
2304512-1	013 00/3/55
2304513-1	013 00/3/53
2304515-1	013 00/3/51
2307814-1	013 00/3/41

PART NUMBER	WP/FIG/INDEX NO.
2307818-1	013 00/3/36
2308001-19	013 00/3/32
2308004-1	013 00/3/27
2308007-1	013 00/3/30
2308011-7	013 00/3/23
2308019-1	013 00/3/33
2308020-1	013 00/3/38
2312801-21	009 00/1/125
2312801-21	013 00/3
2312804-1	013 00/3/1
2312805-1	013 00/3/12
2312806-1	013 00/3/11
2312807-1	013 00/3/2
2312808-1	013 00/3/19
2312809-1	013 00/3/20
2312810-1	013 00/3/18
2312811-1	013 00/3/5
2312812-1	013 00/3/17
2312814-1	013 00/3/4
2312822-1	013 00/3
2312823-1	013 00/3
2312824-1	013 00/3/46
2312825-1	013 00/3/49
2313009-1	013 00/3/47
2333B-4PP	009 00/1/129
2333B-4PP	011 00/5
2520	009 00/1/18
2600052-5	013 00/3/31
2600052-7	013 00/3/35
2600121-1	013 00/3/57
2600765-1	008 00/1/120
2600765-1	011 00/8
2600765-1-1	011 00/8/17
2600765-1-10	011 00/8/2
2600765-1-2	011 00/8/13
2600765-1-4	011 00/8/5
2600765-1-5	011 00/8/6
2600765-1-6	011 00/8/4
2601279-1	013 00/3/42
260129-5	007 00/1/13
2601299-13B	008 00/1/40
2601299-13B	008 00/1/49
2601299-17B	008 00/1/52
2601299-1B	009 00/1/102
2601299-3	007 00/1/22
2601299-33B	008 00/1/27
2601299-33B	008 00/1/58
2601299-3B	008 00/1/80
2601299-3B	009 00/1/94
2601299-5	007 00/1/19
2601299-7B	008 00/1/83
2601299-7B	009 00/1/98
2601425-019	013 00/3/37
2601425-122	013 00/3/34
2601434-1	010 00/3/13
2RA18	009 00/1/4
3-2881	013 00/3/9
3-2884-1	013 00/3/8
3/8-FRM-2	008 00/1/32
3/8-FRM-2	011 00/7
30HP150	009 00/1/119
3300042-1	008 00/1/137
4-4-CTX-B	008 00/1/113
4-4FTX-B	008 00/1/111
4-4GTX-B	009 00/1/152
4-4GTX-SS	009 00/1/142
4-FNTX-B	008 00/1/116
4-WTX-B	008 00/1/115
4111-33	011 00/5/5
415	008 00/1/159
422	009 00/1/49
433-5	011 00/1/4
433-7	011 00/1/3
434-44	011 00/1/1
480H150	009 00/1/118
49A3820	008 00/1/4
49A3919	008 00/1/3
5	010 00/3/18
5016	008 00/1/119
52	010 00/3/12
5208	011 00/1/2
522AS143-1	008 00/1/95
5232	009 00/1/16
5242	009 00/1/15
5252	009 00/1/14
5253	009 00/1/17
5262	009 00/1/12
5263	009 00/1/13
5294	011 00/2/4
52A3751	008 00/1/5
5333B-4PP-6000	009 00/1/130
552AS125-1	009 00/1/131
552AS134-1	008 00/1/54
552AS134-2	008 00/1/65
552AS141-1	009 00/1/132
552AS143-1	009 00/1/135
552AS144-1	009 00/1/134
5611-82X	008 00/1/17
59C6671-2-15	008 00/1/1
601	009 00/1/9

PART NUMBER	WP/FIG/INDEX NO.
613	008 00/1/158
6509-B	011 00/5/1
700375X64	008 00/1/67
700375X64	011 00/4
700375X64-8	011 00/4/8
701842X64	008 00/1/64
701842X64	011 00/4
701842X64-8	011 00/4/8
701872X48	007 00/1/17
701872X48	007 00/1/25
701872X48	011 00/6
701872X48-8	011 00/6/9
701872X52	008 00/1/43
701872X52	008 00/1/53
701872X52	011 00/6
701872X52-8	011 00/6/9
701872X56	008 00/1/30
701872X56	011 00/6
701872X56-8	011 00/6/9
7115F4S	011 00/2
7115H4S	009 00/1/128
72HQ150	009 00/1/120
75A21/RF	009 00/1/46
78-PF8	010 00/3/16
7999	011 00/7/7
8-4TRTX-SS	009 00/1/149
80027-1	011 00/2/12
80117-1	011 00/1/5
805	007 00/1/26
806	009 00/1/165
8184	011 00/7/18
819	007 00/1/27
819	008 00/1/160
819	009 00/1/166
8225	011 00/7/4
8230	011 00/7/13
8231	011 00/7/14
8236	011 00/7/15
8243	011 00/7/6
8245-1	011 00/7/5
8444	010 00/3/17
8834K4	010 00/3/9
90187-1	011 00/2/1
90191-1	011 00/2/16
90194-1	011 00/2/10
90197-1	011 00/2/5
90199-1	011 00/2/9
90200-2	011 00/2/15
90201-1	011 00/2/11
90203-1	011 00/2/6
90204-1	011 00/2/7
90206-2	011 00/2/2
90324-1	011 00/2/8
90327-1	011 00/2/12
90337-1	011 00/2/13
90339-1	011 00/2/14
950	010 00/3/21
9509	011 00/7/1
9584	008 00/1/161
9584	009 00/1/167

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OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

NUMERICAL INDEX OF REFERENCE DESIGNATIONS

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 001 02, dated 1 April 1983

REF. DES.	PART NO.	WP/FIG/INDEX NO.
BD1	552AS124-1	008 00/1/33
BD2	552AS125-1	009 00/1/131
CR1	190350-1	009 00/1/72
CV1	2333B-4PD	009 00/1/129
		011 00/5
C1	190026-1	009 00/1/54
C2	49A3820	008 00/1/4
C3	59C6671-15	008 00/1/1
FU1	190386-9	009 00/1/51
FU2	405240-2	009 00/1/50
F3	405240-1	008 00/1/54
F4	405240-2	008 00/1/65
G1	190405	008 00/1/96
G2	522AS143-1	008 00/1/95
G3	552AS143-1	009 00/1/135
G4	552AS144-1	008 00/1/134
G5	190409-1	009 00/1/136
J1	78-PF8	010 00/1/16
L1	190413-1	009 00/1/28
L2	V-75	009 00/1/45
MS1	190256-5	009 00/1/57
M1	190411-1	009 00/1/123
M1	P90A-184T	012 00/1
M1	2601434-1	010 00/1/13
OL1	190302-15	009 00/1/60
PB1	FA2321-1R0	009 00/1/37
PB2	FA2321-1B0	009 00/1/34
P1	2312801-21	009 00/1/125
RV1	190418-1	008 00/1/31
RV2	190418-3	009 00/1/133
RV3	5333B-4PP-6000	009 00/1/130
RV4	190418-5	008 00/1/66
RV5	190418-3	008 00/1/55
R1	3/8-FRM-2	008 00/1/32
		011 00/7
R1	RC32GF5R6K	010 00/1/15
R2	A472000	010 00/1/5
R3	A43-20	010 00/1/6
R4	RC20GF2222K	010 00/1/14
SN2	190410-1	009 00/1/137
SS1	FA2286-1L	009 00/1/30
ST1	552AS141-1	009 00/1/132
S1	8834K4	010 00/1/9
TC1	190369-1	009 00/1/66
TE1	190357-1	009 00/1/3
TS1	190282-1	009 00/1/1
TS2	180007-1	009 00/1/2
T1	190039-7	009 00/1/63
VA1/HTR1	160047-1	009 00/1/83
VP1	2200902-1	008 00/1/100
VP3	2200901-1	008 00/1/97
V1	701842X64	008 00/1/64
		011 00/4
V2	701872X52	008 00/1/53
		011 00/6
V3	190406-1	008 00/1/99
		011 00/1
V4	701872X56	008 00/1/30
		011 00/6
V5	701872X52	008 00/1/43
V6	701872X48	007 00/1/25
		011 00/6
V7	M2T/BRASS+ P4=(3)	008 00/1/98
V8	1872	008 00/1/86
		011 00/3
V9	1872	009 00/1/87
		011 00/3
V10	7115H4S	009 00/1/128
		011 00/2
V11	2600756-1	008 00/1/120
		011 00/8
V12	701872X48	007 00/1/17
V13	700375X64	008 00/1/67
		011 00/4

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

LIST OF TECHNICAL PUBLICATION DEFICIENCY REPORTS
(TPDR) INCORPORATED

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

Identification No./ QA Sequence No.	Location
NONE	

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

INTRODUCTION

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 002 00, dated 1 April 1983

1. PURPOSE OF MANUAL.

2. This manual provides operation and maintenance instructions with illustrated parts breakdown, for Cryogenic Service System (hereinafter referred to as system), Part Number 160021-1 and 160021-3. Storage tank assemblies (Part Number 160001-1 and 160001-3) are integral parts of the applicable cryogenic service system.

3. ARRANGEMENT OF MANUAL.

4. This manual contains an alphabetical index work package (WP), an introductory WP and technical content WP's. Technical WP's are independent, self-contained procedures that may be used as handouts to support specific functional tasks. Each WP is maintained as a separate entity; changes result in a reissue of the specific WP. WP's are identified by unique, five digit numbers appearing in upper right hand corner of each page. The number provides a means of locating WP's, permits rapid assembly of a complete manual, and is used for referencing within manual. A numerical index of effective WP's, listing all WP's, is provided on the "A" page. This listing is used to locate desired WP required to perform specific maintenance task.

5. QUALITY ASSURANCE REQUIREMENTS.

6. Certain procedures or steps in the manual are followed with "QA" in parenthesis. Improper performance of these procedures or steps may cause equipment failure of personnel hazards. A quality assurance inspection of each ("QA") step previously accomplished shall be made prior to proceeding to next step, unless it can be determined that such inspection can be performed after completing entire procedure.

7. RECORD OF APPLICABLE TECHNICAL DIRECTIVES.

8. Technical directives applicable to this manual are listed below by directive type/number, date of issue, title, date of incorporation, and remarks. These technical directives also appear on title page of each subsequent applicable WP.

Type/Number	Date	Title and ECP No.	Date Incorporated	Remarks

9. INTRODUCTION TO THE ILLUSTRATED PARTS BREAKDOWN.

10. GENERAL. The complete Ilustrated Parts Breakdown (IPB) contains information applicable to the Cryogenic Service Systems, part numbers 160021-1 and 160021-3 designed by Hex Industries and manufactured by Cosmodyne Corporation. It lists and describes the parts necessary for equipment support and is used for requisitioning, identifying parts and for illustrating disassembly and assembly relationships.

11. GROUP ASSEMBLY PARTS LIST (GAPL). The GAPL consists of a breakdown of the complete unit into subassemblies and detail parts. Attaching parts are identified immediately following the item they attach. The GAPL is a five column format. All symbols and abbreviations used in the GAPL are in accordance with MIL-STD-12, Abbreviations For Use On Drawings and in Technical Type Publications.

12. Index Number. In this column the index numbers are assigned in numerical sequence and are essentially in disassembly sequence. After the index numbers are assigned in this column, they are then added to the line art exploded view of the equipment/ repairable.

13. Part Number. This column lists the prime contractor part number, government standard part number or other vendor part number.

14. Description. This column lists the item nomenclature plus those modifiers necessary to identify the item. The assemblies, subassemblies, detail parts and attaching parts are properly identified (named or indented) to show their relationship to the assembly. Attaching parts are listed immediately after the part they attach and preceding any details of the assembly. The caption /ATTACHING PARTS/ appears in the description column preceding the attaching parts and the symbol ---*--- is used to indicate the end of the attaching parts for that part or assembly.

15. Vendors Codes. Part numbers other than those of Hex Industries and standard parts are designated by vendor code numbers in / / following the nomenclature of the part. This code is in accordance with the Federal Supply Code For Manufacturers Cataloging Handbook H4 and H3. If a code has not been assigned, the vendors complete name and address will appear.

16. Make From. For those simple items, i.e., hoses, lines, tubes, brackets, cables etc., coded for local manufacture, the material from which the item is manufactured will be included in / / after the item nomenclature or vendor code number.

17. LOX Items. Items identified with /LOX CLEAN/ require LOX cleaning and may be used in either nitrogen or oxygen tank assemblies.

18. Units Per Assembly. This column will list the total number of each part required per assembly or subassembly and are not necessarily the total number used in the end item of equipment. The letters "AR" (As Required) are used to identify bulk items. The abbreviation "REF" indicates Reference and indicates the part has been listed and illustrated elsewhere in the IPB and is included in the present listing for reference only.

19. Usable On Code. This column indicates the usability of parts on different models or series of the equipment. If no letter appears in this column, the part may be used on all models/series of the end item of equipment. Usable On codes are listed following the Introduction To The Illustrated Parts Breakdown in each applicable Work Package.

20. Source, Maintenance and Recoverability Code (SM&R). This column contains the SM&R codes as assigned by the government. Definitions of these codes and parts kits information are contained in NAVAIRINST 4423.3.

21. NUMERICAL INDEX. The Numerical Index (WP 001 01) is a complete alphanumeric tabulation of part numbers or noun names if a part number has not been assigned. Alphabetic "O"s are considered numeric zeros.

22. Part Number Column. This column lists all part numbers that appear in the Part Number column of the GAPL. This column also lists the identifying noun in lieu of part number when no part number has been assigned. Part numbers are listed in alphanumeric sequence.

23. Work Package/Figure/Index Number. This column lists the WP/Fig/Index No. assigned to the associated part number. The numbers are separated by slashes, the first number being the Work Package in which the part number is located, the second is the Figure Number within the WP and the third number is the index number identifying the part within the figure.

24. REFERENCE DESIGNATION INDEX. The Reference Designation Index (RefDes) (WP 001 02) lists the reference designation symbols which have been established for components of the equipment being covered. The RefDes are assigned by the contractor.

25. Reference Designation (RefDes) Column. This column lists the assigned reference designation symbols, arranged in alphanumeric sequence. This list contains all reference designation symbols contained in schematic diagrams and text pertaining to the equipment covered by the IPB.

26. Work Package/Figure/Index Column. This column contains the Work Package, Figure and Index Number reference for the part assigned the reference designation.

27. Part Number Column. This column lists the part number of the item assigned the specific reference designation.

28. HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN. The following instructions are provided to assist the user in researching within the IPB.

29. When The Part Number Is Not Known. Determine the function and application of the part required. Turn to the Alphabetical Index (WP 001 00) and select the most appropriate Group, System or Component Work Package.

30. Turn to the WP indicated and locate the desired part on the illustration.

31. From the illustration, obtain the index number assigned to the part desired. Refer to the GAPL for the identifying noun name and any other specific information including the item part number.

32. When The Part Number Is Known. Refer to the Numerical Index (WP 001 01). Locate the part number and note the Work Package, Figure and Index Number assigned to the part number.

33. Turn to the WP and Figure indicated and locate the index number referenced.

34. If a pictorial representation of the part, or its location is desired, refer to the same index number on the accompanying illustration.

35. When The Reference Designation Is Known. Refer to the Reference Designation Index (WP 001 02). Locate the reference designation and note the Work Package, Figure and Index Number and the Part Number assigned to that RefDes.

36. Turn to the WP and Figure indicated and locate the Index Number referenced in the RefDes Index.

37. If a pictorial representation of the part, or its location, is desired, refer to the same index number on the accompanying illustration.

Table 1. NAVY APPLICATION OF JOINT SERVICES UNIFORM SM&R CODES

SOURCE (D012)				MAINTENANCE USE (D013A)		REPAIR (D013B)		RECOVERABILITY (D013C)	
1st POSITION		2nd POSITION		3rd POSITION		4th POSITION		5th POSITION	
P	PROCURE	A	REPLENISH	O	REPLACE OR USE AT ORG. LEVEL	Z	NO REPAIR (CONSUMABLE)	O	REPAIRABLE ITEM. CONDEMN AT ORGANIZATIONAL LEVEL.
		B	INSURANCE						
		C	CURE-DATED						
		D	INITIAL	F H G	REPLACE OR USE AT IMA LEVEL	B	RECONDITION BY ADJUSTMENT, CALIBRATION, LUBRICATION, PLATING, ETC.	F H G	REPAIRABLE ITEM. CONDEMN AT INTERMEDIATE LEVEL INDICATED.
		E	END ITEM GSE/STOCKED						
		F	GSE/NOT STOCKED						
K	REPAIR KIT COMPONENT	F	ORG/IMA	L	REPLACE OR USE AT SPECIALIZED IMA	O	REPAIR AT ORG. LEVEL	L	REPAIRABLE ITEM. CONDEMN AT SPECIALIZED INTERMEDIATE LEVEL.
		D	DEPOT						
		B	BOTH KITS						
M	MANUFACTURE	O	ORG	D	REPLACE OR USE AT DEPOT	F H G	REPAIR AT IMA LEVEL	D	REPAIRABLE ITEM. CONDEMN AT DEPOT OR CONTRACTOR FACILITY.
		F	IMA AFLOAT						
		H	IMA ASHORE					A	SPECIAL HANDLING REQUIRED. CONTACT ITEM MANAGER FOR DISPOSAL INSTRUCTIONS.
A	ASSEMBLE	G	IMA BOTH						
		D	DEPOT					Z	NON-REPAIRABLE ITEM. CONDEMN AT LEVEL INDICATED IN 3rd POSITION.
X	MISC	A	REQUEST NHA			L	REPAIR AT SPECIALIZED IMA		
		B	OBTAIN FROM SALVAGE OR ONE TIME BUY	Z	NOT REQD THIS APPLIC	D	REPAIR AT DEPOT OR COMMER.		
		C	DIAGRAMS–SCHEMATICS INSTALL. DWGS.						

SERVICE OPTION (D012A)	
	6th POSITION
1 2 3	APPLIES TO ENGINES ONLY. IDENTIFIES THE HIGHEST (1) TO LOWEST (3) LEVEL OF MAINTENANCE WHICH CAN REPLACE (3rd POSITION OF SMR CODE) THE ITEM.
4 5 7	SAME AS ABOVE. IN ADDITION, ITEM IS A FLR WITH A UNIT COST OF OVER $5000. THESE CODES ARE NO LONGER ASSIGNED TO NEW, NON-FAMILY RELATED ITEMS.
6	NORMALLY PROCURED AND STOCK NUMBERED BUT ORGANIC CAPABILITY EXISTS FOR EMERGENCY STOP-GAP REQUIREMENTS.
E	END-TO-END TEST REQUIRED BY IMA PRIOR TO BCM ACTION.
J	FLR OR CONSUMABLE ITEM. CHANGE 5th POSITION OF SMR CODE TO "O" UNDER PICA/SICA. NAVAIR APPROVAL REQUIRED.
8	SAME AS "J" ABOVE EXCEPT USED FOR ENGINES ONLY. APPLIES TO 3rd LEVEL OF IMA.
9	SAME AS "J" ABOVE EXCEPT USED FOR ENGINES ONLY. APPLIES TO 2nd LEVEL OF IMA.
M	ITEM IS A FLR WITH A UNIT COST OF OVER $5000. THIS CODE IS NO LONGER ASSIGNED TO NEW NON-FAMILY RELATED ITEMS.
N	ASSIGNED TO XB SOURCE CODE AND INDICATES ITEM IS PROCURED LOCALLY. NOT STOCKED IN THE SUPPLY SYSTEM.
T	ASSIGNED TO TRAINING DEVICES WITH SOURCE CODE OF "PD". INDICATES ITEM IS NOT A PROCURABLE SPARE. NSN IS ASSIGNED ONLY TO PERMIT VISIBILITY OF REPAIR PART RELATIONSHIP.

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

PRINCIPLES OF OPERATION

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 003 00, dated 1 April 1983

Reference Material

None

Alphabetical Index

Record of Applicable Technical Directives

None

1. PURPOSE.

2. The primary purpose of the system is to store and dispense (as liquid or high pressure gas) liquid oxygen (Part No. 160021-1) or liquid nitrogen (Part No. 160021-3).

3. DESCRIPTION. (Figure 1.)

4. The system consists of a cryogenic liquid storage tank assembly and a converter assembly integrated into one fully enclosed unit. Access for maintenance and operation is provided by appropriate doors and panels. Lifting eyes and lifting/tiedown rings are provided on the storage tank assembly to facilitate handling and transporting of the system. A liquid servicing hose is provided with the liquid oxygen system.

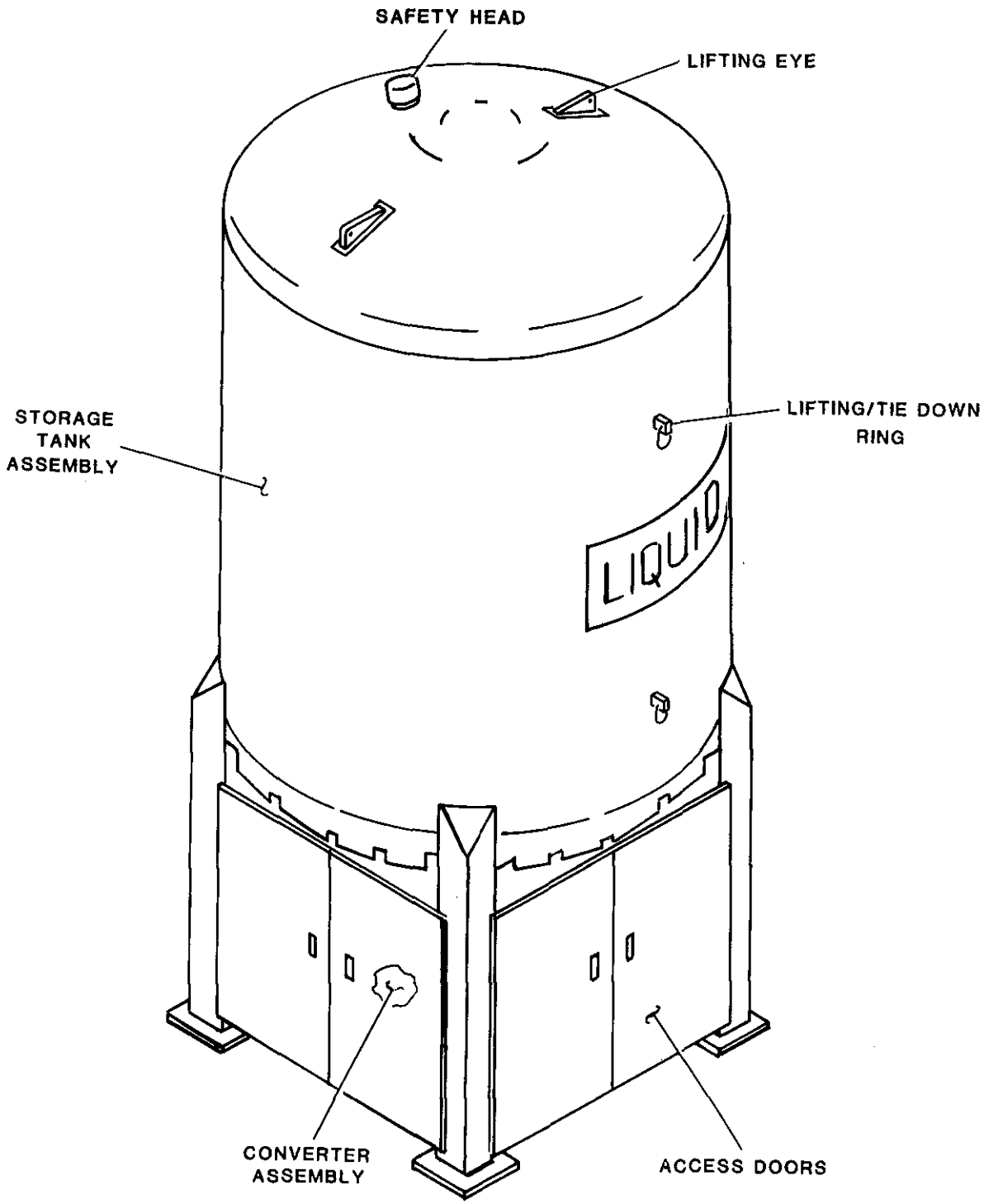


Figure 1. Cryogenic Service System, Part No. 160021-1 and 160021-3

5. LEADING PARTICULARS.

6. Refer to Table 1 for leading particulars and characteristics of the system.

TABLE 1. LEADING PARTICULARS

Service	Liquid Oxygen (Part No. 160021-1) Liquid Nitrogen (Part No. 160021-3)
Storage Tank Capacity	2000 gallon plus 10% ullage (Part No. 160001-1 and 160001-3)
Operating Pressure	55 psig max (inner vessel)
Flow Rates (Low Pressure System):	
Fill and Drain Line	100 gpm
Servicing Line	25 gpm
Gas Delivery (High Pressure System):	
Delivery Pressure	5000 psig max
Flow:	
Oxygen	7600 scfh
Nitrogen	6200 scfh
Electric Power Requirements	240/480 VAC, 3 Phase 60 Hz, 35 KW
Weight:	
Empty	12000 pounds
Full	31000 pounds (Oxygen) 25500 pounds (Nitrogen)
Dimensions:	
Height	200 inches
Diameter	96 inches

7. DETAILED DESCRIPTION.

8. STORAGE TANK ASSEMBLY. The storage tank assembly consists of an inner and outer shell with annular space between to provide insulation space. Insulation of the inner vessel is provided by filling the annular space between the inner and outer vessels with a granular, low-conductive material (perlite) and then evacuating the annular space to 100 microns (Hg). The outer jacket safety head protects the inner vessel in the event of pressure buildup in the annular space (approximately 15 psig) due to tank damage. The lower structure assembly of the storage tank contains the converter system assembly, piping and external hardware and controls for the system. The liquid servicing hose (reeled up on a carrier) is also contained in the lower structure of the oxygen system.

9. CONVERTER ASSEMBLY. The converter system consists of a motor driven cryogenic pump, electric vaporizer and related piping, electrical circuitry and controls. The pump draws low-pressure liquid (up to 50 psig) from the storage tank assembly, pressurizes it to the desired pressure (up to 5000 psig) and directs it to the vaporizer. The vaporizer converts the high pressure cryogenic liquid to warm high-pressure gas. A temperature controller cycles the vaporizer to maintain a pre-selected gas temperature (+30° to +100°F).

10. CRYOGENIC PUMP. A single-cylinder, positive displacement, reciprocating pump is used to raise the pressure of the cryogenic fluid before it is directed to the electric vaporizer. The pump is driven through a timing belt drive by a 5 hp electric motor. The belt drive reduces the motor speed from 1750 rpm to 730 rpm at the pump producing a flow rate of 1.10 gpm at pressures up to 5000 psig.

11. ELECTRIC VAPORIZER. The high pressure cryogenic fluid is converted to oxygen or nitrogen gas by the electric vaporizer. Stainless steel heat exchanger tubes and electric heating elements are incapsulated within a solid aluminum casting. Heat generated by the electric heating elements is transmitted by the highly conductive aluminum to the heat exchanger tubes where it is absorbed by the cryogenic fluid changing it to a gas. A high temperature switch (TS-2) protects the vaporizer from overheating in the event of flow stoppage or other malfunction.

12. CONTROLS AND INDICATORS. The low pressure panel located on the storage tank contains a vacuum gage for reading tank-annulus-vacuum level, a tank liquid level gage and a tank pressure gage. The converter or high pressure panel contains a pump suction pressure gage, gas discharge pressure gage and switch, gas discharge temperature gage, and low

and high pressure bleed valves. The converter system control box is of explosion-proof construction and contains the pump, motor starter, vaporizer contactor, temperature controller, control transformer, indicator lights and switches required to operate the converter system. Refer to WP 005 00 for location and function/purpose of controls, indicators and valves.

13. PRINCIPLES OF OPERATION. (Figures 2 and 3.)

14. ELECTRIC POWER. The system is designed to operate on 240 or 480 vac, 3 phase external power. The system is factory wired for 480 vac, 3 phase power operation. Conversion to 240 vac, 3 phase power operation is possible by rewiring transformer T1, vaporizer VA-1, and replacing motor starter overload OL-1 with 240 vac rated overload. Refer to Figure 2. Check motor M-1 wiring for correct service voltage. If incorrect, change in accordance with motor diagram plate.

15. LIQUID DELIVERY. To transfer liquid out of the storage tank, first determine proper transfer pressure of tank to be filled and buildup required transfer pressure in the storage tank. This is accomplished by admitting liquid from the tank into the pressure buildup coil (P.B. coil) through valve (V-5). The pressure buildup coil is an ambient air heat exchanger which vaporizes the liquid and returns resultant gas to tank headspace via the tank vent line increasing tank pressure. Liquid is pressure expelled through servicing line connections (C-2) or (C-4) via valve (V-2).

16. HIGH PRESSURE GAS DELIVERY. Liquid is directed to the pump (P-1) through pump suction valve (V-12), converted to high pressure liquid by the pump, vaporized by vaporizer (VA-1) and then directed to the gas receiver connected to high pressure gas service line connection (C-5). To pump a cryogenic fluid, it is necessary that the temperature of the liquid entering the pump be sub cooled, or far enough below its boiling point, so that heat energy added to the liquid by the pump (in pumping) does not induce boiling of the liquid and cause cavitation. To ensure this condition, several precautions are required.

a. The pump is cooled down from ambient to near the temperature of the liquid by allowing the liquid to bleed through the pump (opening valves (V-12), (V-6) and (V-9). When a liquid (not a gas) is flowing from valve (V-9), the pump is cooled down to operating temperature (a process which normally requires 10 to 15 minutes).

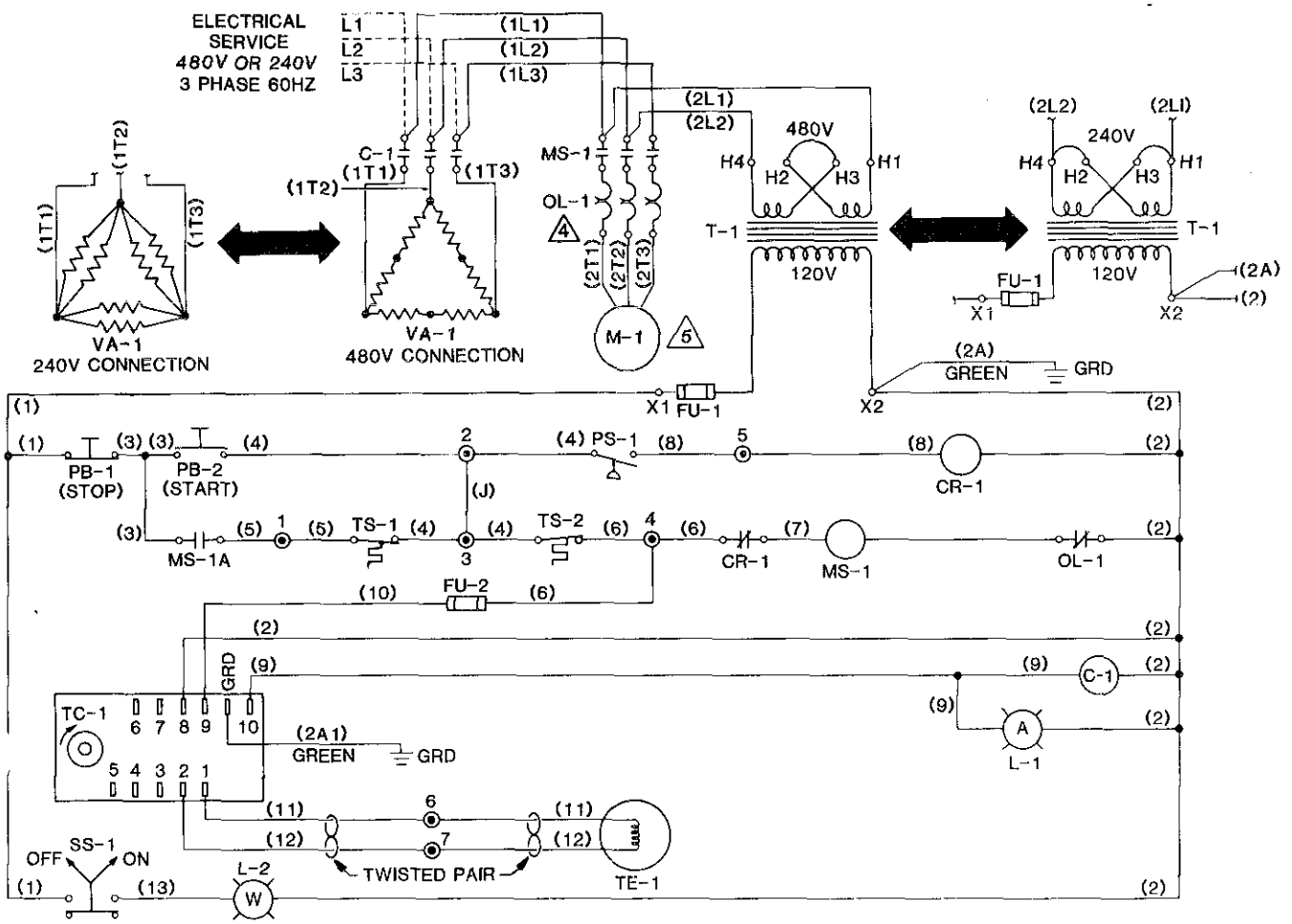
b. If the pump cavitates because of boiling (heat-saturated) liquid at the inlet, the pump must be stopped and liquid sub cooled. A boiling liquid is said to be saturated; a non-boiling liquid is said to be sub cooled. The amount of sub cooling available at the pump inlet is known as Net Positive Suction Head (NPSH), expressed in psi. For example, if liquid nitrogen is boiling in a supply source level under a headspace pressure of 20 psig, adding an additional 10 psig will cause the boiling to stop. The liquid is now said to have 10 psig sub cooling. The amount of sub cooling available in terms of temperature is the difference between the boiling point at 20 psig and the boiling point at 30 psig.

NOTE

Sub cooling is not the total pressure on the liquid, only the amount added to suppress boiling. The cryogenic pump requires 5 psig minimum sub cooling fixed by design.

c. The easiest way to sub cool is to vent the tank and allow excess heat to boil away, then close the vent and build some additional headspace pressure. The alternate choice is to increase vessel headspace pressure without venting, although this may not be practical if the pressure is already near the relief device settings (vent line pressure regulator (R-1) set at 50 psig.

17. FILLING. Fill connection (C-1) provides for connecting system to a supply source for filling storage tank assembly. Valves (V-13) and (V-1) allow supply flow to enter storage tank. Gage (G-1) indicates storage tank liquid level and gage (G-2) indicates tank pressure. Excessive pressure buildup in storage tank during filling operation is relieved manually with vent valve (V-4). Relief valve (RV-1) and burst disc (BD-1) provide automatic overpressure protection for the storage tank. Connection (C-8) provides for manifolding several storage tanks to permit simultaneous filling. This filling operation is accomplished via valve (V-1).



LEGEND	
C-1	CONTACTOR, VAPORIZER
CR-1	CONTROL RELAY
FU-1	FUSE (5 AMP)
FU-2	RECTIFIER FUSE (1 AMP)
VA-1	VAPORIZER (30KW)
L-1	LIGHT, "VAPORIZER ON"
L-2	LIGHT, COMPARTMENT
M-1	MOTOR, PUMP (5HP)
MS-1	MOTOR STARTER, MAGNETIC (SIZE 1)
MS-1A	AUX. CONTACT, MOTOR STARTER
OL-1	OVERLOADS, MOTOR STARTER
PB-1	PUSH BUTTON SWITCH, "STOP"
PB-2	PUSH BUTTON SWITCH, "START"
PS-1	PRESS. SW., GAS DISCHARGE (200-5000 PSIG)
SS-1	SELECTOR SWITCH, COMPARTMENT LIGHT
T-1	TRANSFORMER (240-480/120 VAC, 0.3 KVA)
TC-1	TEMPERATURE CONTROLLER (30°-100°F)
TE-1	TEMPERATURE SENSOR (THERMISTOR)
TS-1	LOW TEMPERATURE SAFETY SWITCH (OPENS @ 30°F ON FALL)
TS-2	HIGH TEMPERATURE SAFETY SWITCH (OPENS @ 185°F ON RISE)

WIRE DESIGNATION	SIZE (AWG)	TYPE	COLOR
1L1, 1L2, 1L3	12	THW	WHITE
2L1, 2L2	12	THW	WHITE
1T1, 1T2, 1T3	8	TEFLON	WHITE
2T1, 2T2, 2T3	12	THW	WHITE
1 THRU 10,&13	16	THW	WHITE
11 & 12	22	TEFLON	WHITE
2A	12	THW	GREEN
2A1	16	THW	GREEN

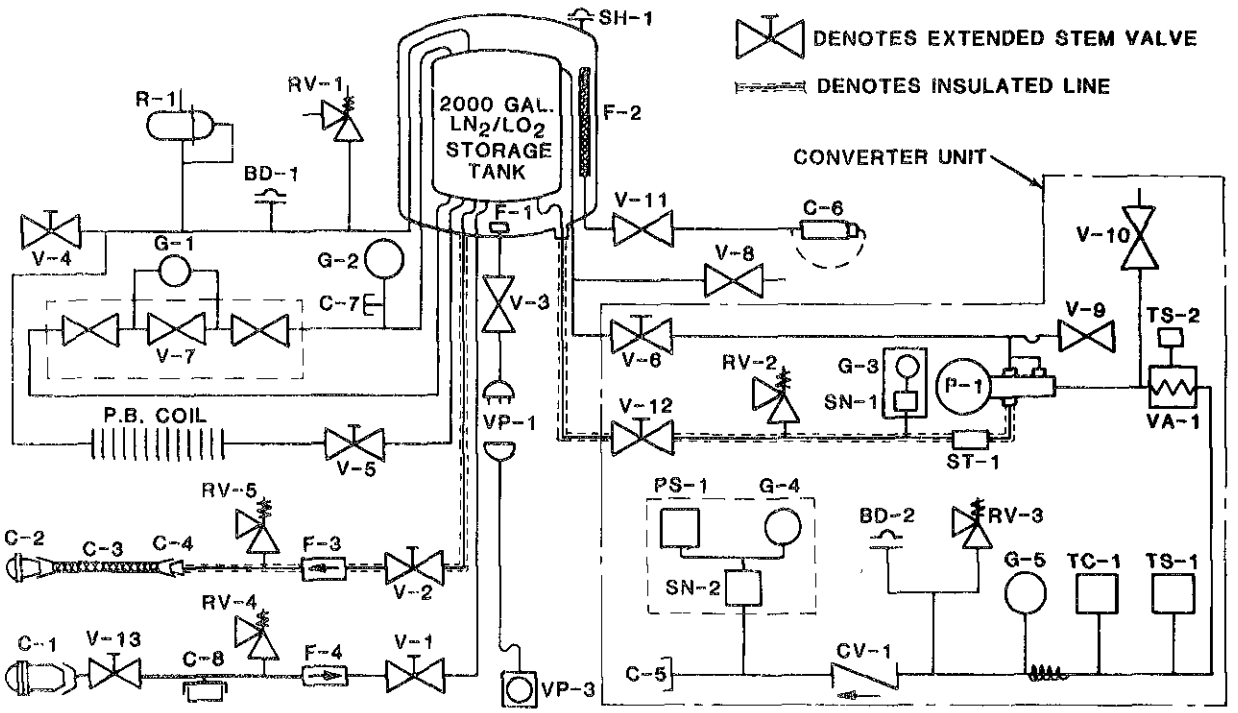
1. ( ) DENOTES WIRE NUMBER.
   (J) DENOTES JUMPER.
2. ⊙ DENOTES WIRE CONNECTION ON TERMINAL BOARD.

△3 STRANDED WIRE PER MIL-W-16878/4A OR 5.

△4 240 OR 480 VAC OVERLOAD TO BE USED DEPENDING ON POWER SOURCE.

△5 MOTOR WIRED FOR EITHER 240 OR 480 VAC DEPENDING ON POWER SOURCE.

Figure 2. System Wiring Diagram



	LEGEND		
BD-1	BURST DISC, TANK (87 PSIG)	RV-3	RELIEF VALVE, HIGH PRESSURE GAS DISCHARGE (6000 PSIG)
BD-2	BURST DISC, HIGH PRESSURE (7000 PSIG)	RV-4	RELIEF VALVE, FILL LINE (90 PSIG)
C-1	CONNECTION, FILL	RV-5	RELIEF VALVE, LIQUID SERVICING LINE (75 PSIG)
C-2	CONNECTION, LIQUID SERVICE LINE (LO2 ONLY)	SH-1	SAFETY HEAD, TANK
C-3	HOSE, LIQUID SERVICING (LO2 ONLY)	SN-1	SNUBBER, PUMP SUCTION PRESSURE GAUGE
C-4	CONNECTION, LIQUID SERVICING HOSE	SN-2	SNUBBER, PUMP DISCHARGE PRESSURE GAUGE
C-5	CONNECTION, HIGH PRESSURE GAS DISCHARGE	ST-1	STRAINER, PUMP INLET
C-6	CONNECTION, EVACUATION	TC-1	TEMPERTURE CONTROLLER, GAS DISCHARGE (ADJUSTABLE, 30-100°F)
C-7	CONNECTION, PRESSURE SENSING		
CV-1	CHECK VALVE, HIGH PRESSURE GAS DISCHARGE	TS-1	SWITCH, LOW TEMPERATURE SAFETY (30°F)
F-1	FILTER, VACUUM PROBE	TS-2	SWITCH, HIGH TEMPERATURE SAFETY (185°F)
F-2	FILTER, EVACUATION	V-1	VALVE, FILL & TRANSFER (2"GATE)
F-3	FILTER, LIQUID SERVICING LINE	V-2	VALVE, SERVICING LINE (1 GLOBE)
F-4	FILTER, FILL LINE	V-3	VALVE, VACUUM PROBE (1/4" BELLOWS SEAL)
G-1	GAGE, TANK LIQUID LEVEL	V-4	VALVE, TANK VENT (2" GLOBE)
G-2	GAGE, TANK PRESSURE	V-5	VALVE, PRESSURE BUILDUP (1" GLOBE)
G-3	GAGE, PUMP SUCTION PRESSURE	V-6	VALVE, PUMP VAPOR RETURN (1/2" GLOBE)
G-4	GAGE, PUMP DISCHARGE PRESSURE	V-7	3-WAY VALVE, TANK LEVEL GAUGE
G-5	GAGE, GAS DISCHARGE TEMPERATURE	V-8	VALVE, FULL TRYCOCK (1/2" GLOBE)
P-1	PUMP, HIGH PRESSURE LO2 OR LN2	V-9	VALVE, LOW PRESSURE BLEED (1/2" GLOBE)
PS-1	SWITCH, DISCHARGE PRESSURE (ADJUSTABLE, 200-5000 PSIG)	V-10	VALVE, HIGH PRESSURE BLEED (1/4" BALL)
		V-11	VALVE, EVACUATION (1 1/2")
R-1	PRESSURE REGULATOR, VENT LINE (SET @ 50 PSIG)	V-12	VALVE, PUMP SUCTION (1/2" GLOBE)
		VA-1	VAPORIZER (30 KW)
RV-1	RELIEF VALVE, TANK (55 PSIG)	VP-1	VACUUM PROBE
RV-2	RELIEF VALVE, PUMP SUCTION LINE (75 PSIG)	VP-3	INDICATOR, VACUUM
C-8	CONNECTION, ALTERNATE LIQUID TRANSFER	V-13	VALVE, FILL (2" GATE)

Figure 3. System Flow Diagram

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

PREPARATION FOR USE, STORAGE OR SHIPMENT

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 004 00, dated 1 April 1983

Reference Material

Aviators Breathing Oxygen (ABO) Surveillance Program	NAVAVNLOGCENINST 10332.1
Marking for Shipment and Storage	MIL-STD-129
Oxygen/Nitrogen Cryogenic Systems	NAVAIR 06-30-501
Periodic Maintenance Requirement Cards (Cryogenic Service System)	NAVAIR 19-600-206-6-2
Periodic Maintenance Requirement Cards (Storage Tank Assembly)	NAVAIR 19-600-207-6-2
Preoperational Checklist (Cryogenic Service System)	NAVAIR 19-600-206-6-1
Preoperational Checklist (Storage Tank Assembly)	NAVAIR 19-600-207-6-1
Preservation and Packaging	MIL-STD-281

Alphabetical Index

Record of Applicable Technical Directives

None

1. PREPARATION FOR USE.

WARNING

Refer to NAVAIR 06-30-501 and NAVAVNLOGCENINST 10332.1 for information concerning handling of Oxygen/Nitrogen Cryogenic systems.

CAUTION

Do not install system with pressure buildup coil up against a structure inhibiting ambient air flow.

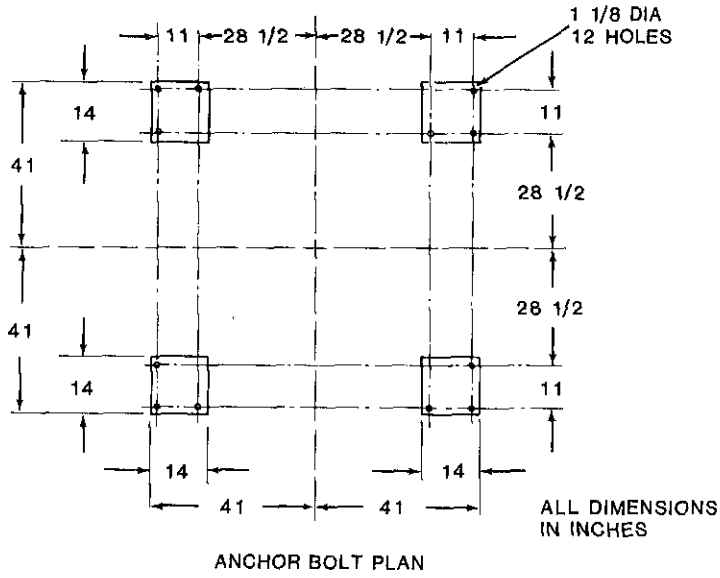


Figure 1. Anchor Bolt Layout

CAUTION

Ensure that systems electrical connections are compatible with external power source.

NOTE

Motor rotation (as viewed from motor shaft end) must be clockwise. If not, reverse any two leads of external power source.

2. The system is shipped assembled with storage tank empty. Install using anchor bolt layout shown in Figure 1. Check systems electrical power connections (240 or 480 vac), refer to Figure 2, WP 003 00. Convert if necessary to external power source to be used. Ensure that correctly rated (240 or 480 vac) starter overload OL-1 is installed. After applicable installation, the system is ready for filling and operation. Perform preoperational checks and periodic maintenance in accordance with NAVAIR 19-600-206-6-1, -6-2, and NAVAIR 19-600-207-6-1, -6-2. Operate system, refer to WP 005 00.

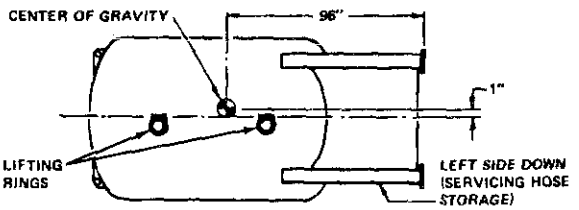
3. PREPARATION FOR STORAGE.

4. Prepare system for storage as follows:

a. Drain and purge/LOX wash the storage tank. Refer to NAVAVNLOGCENINST 10332.1. Close all valves and cap all connections.

b. Disconnect external main power wiring (if required) and seal electric control box against moisture. Remove batteries from vacuum indicator VP-3.

c. Disconnect any plumbing lines which may be connected to facility lines.



SHIPPING WEIGHT: 12000 LBS *
SHIPPING CUBAGE: 1200 CU FT

LENGTH: 200 IN.
WIDTH: 96 IN.
HEIGHT: 96 IN.

* 11000 LBS WITHOUT CONVERTER

Figure 2. Lifting/Storage Diagram

d. Preserve and package system in accordance with MIL-STD-281.

e. Mark system in accordance with MIL-STD-129.

5. PREPARATION FOR SHIPMENT.

6. Perform storage procedures, refer to paragraph 4. Proceed as follows, referring to Figure 2.

a. Close all doors and secure all accessories.

b. Attach double spreader bars to crane hook (minimum 96 inches wide). Attach spreader bar lines to lifting rings.

WARNING

To avoid personnel injury, do not stand near system during lifting/repositioning operation.

CAUTION

To avoid system damage, use guide/control lines to guide system during lifting/ repositioning operation.

c. When setting system down in the horizontal position, make certain that the servicing hose storage side is face down.

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

OPERATION INSTRUCTIONS

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 005 00, dated 1 April 1983

Reference Material

Aviators Breathing Oxygen (ABO) Surveillance Program	NAVAVNLOGCENINST 10332.1
Oxygen/Nitrogen Cryogenic Systems	NAVAIR 06-30-501
Periodic Maintenance Requirement Cards (Cryogenic Service System)	NAVAIR 19-600-206-6-2
Periodic Maintenance Requirement Cards (Storage Tank Assembly)	NAVAIR 19-600-207-6-2
Preoperational Checklist (Cryogenic Service System)	NAVAIR 19-600-206-6-1
Preoperational Checklist (Storage Tank Assembly)	NAVAIR 19-600-207-6-1

Alphabetical Index

Record of Applicable Technical Directives

None

Support Equipment Required

Nomenclature	Part No.
Nitrogen Cylinder/ Regulator	0781-6043 FSCM 63026

NOTE

Equivalent substitute items may be used.

Materials Required

Nomenclature	Part No.
Nitrogen Gas	BB-N-411, Grade A, Type 1

1. SCHEDULE MAINTENANCE.

2. To accomplish preoperational and periodic maintenance on the system, refer to NAVAIR 19-600-206-6-1, -6-2, and NAVAIR 19-600-207-6-1, -6-2.

3. OPERATING CONTROLS AND INDICATORS.

4. Controls and indicators required for system operation are identified in Figure 1 and their functions explained in Table 1.

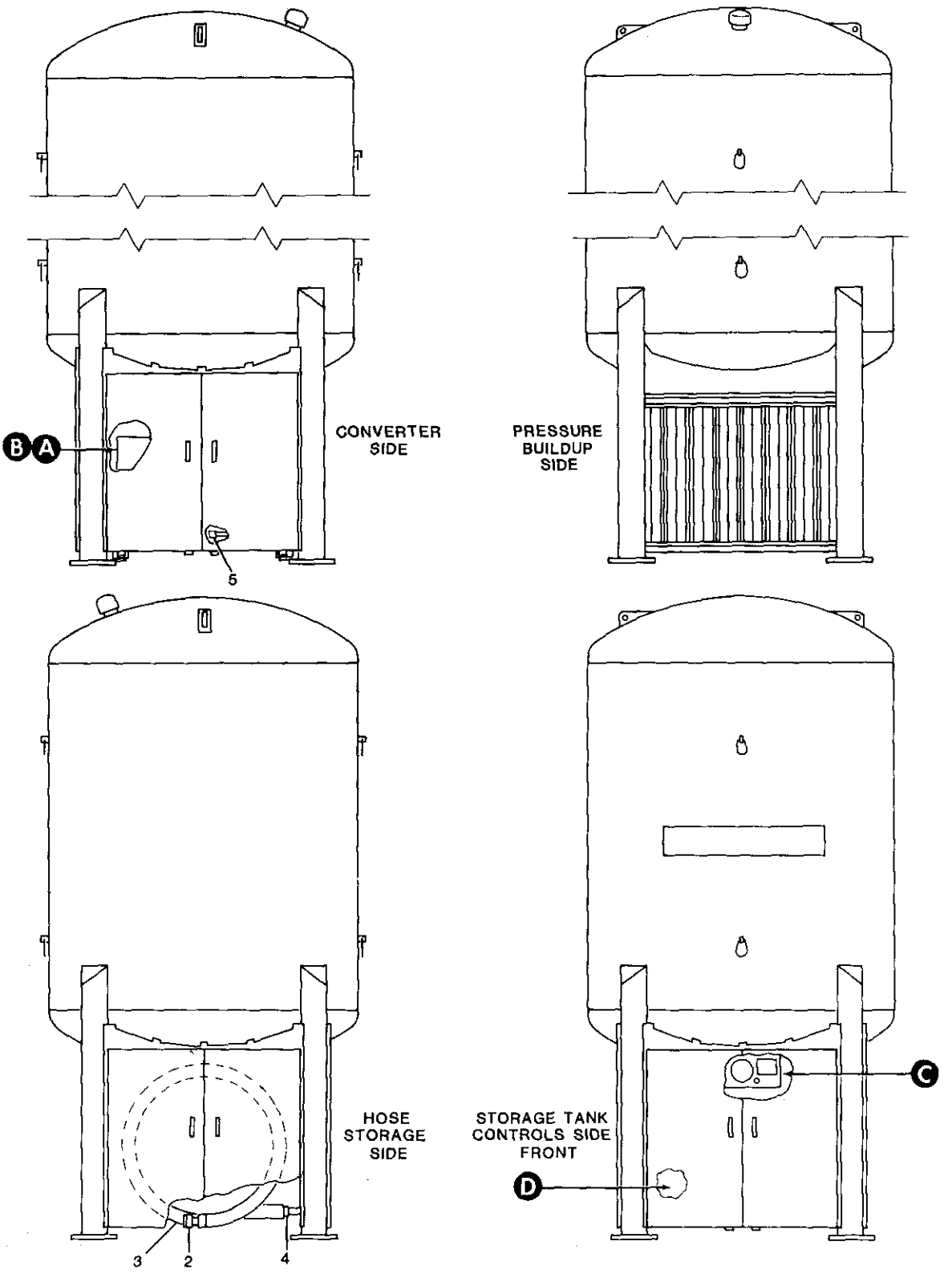


Figure 1. Controls and Indicators (Sheet 1 of 2)

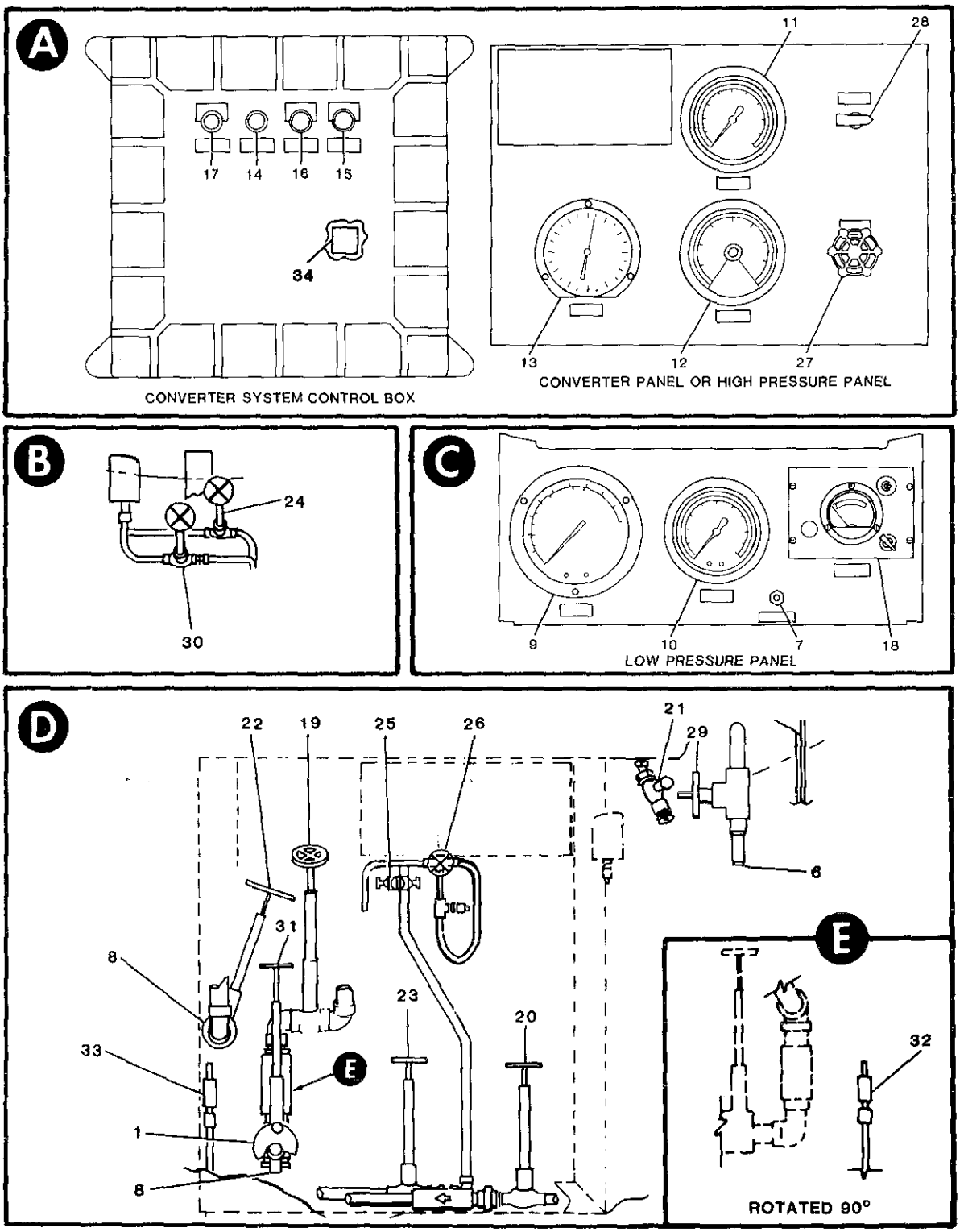


Figure 1. Controls and Indicators (Sheet 2)

TABLE 1. CONTROLS AND INDICATORS

Item No. (Figure 1)	Control/Indicator	Function
1	FILL/DRAIN CONNECTION C-1	Provides connection for system fill/drain.
2	LIQUID SERVICING CONNECTION C-2	Provides connection for liquid oxygen transfer operations.
3	LIQUID SERVICING HOSE (LO_2 ONLY) (C-3)	Provides connection between C-2 and C-4.
4	LIQUID SERVICING HOSE CONNECTION (C-4)	Provides connection for servicing hose.
5	HIGH PRESSURE GAS DISCHARGE CONNECTION C-5	Provides connection for high pressure gas discharge operation.
6	EVACUATION CONNECTION (C-6)	Provides connection for evacuation of tank annulus pressure.
7	PRESSURE SENSING CONNECTION C-7	Provides connection for tank pressure sensing.
8	ALTERNATE LIQUID TRANSFER CONNECTION (C-8)	Provides connection for alternate liquid transfer operation.
9	TANK LIQUID LEVEL GAGE G-1	Indicates tank liquid level. Range is 0 to 2000 gallons.
10	TANK PRESSURE GAGE G-2	Indicates tank pressure. Range is 0 to 100 psig.
11	PUMP SUCTION PRESSURE GAGE G-3	Indicates tank pump inlet pressure. Range is 0 to 100 psig.
12	GAS DISCHARGE PRESSURE GAGE/SWITCH G-4/PS-1	Indicates gas discharge pressure. Range is 0 to 8000 psig. Integral adjustable switch shuts down system automatically when receiver vessel is full.
13	GAS DISCHARGE TEMPERATURE GAGE G-5	Indicates high pressure gas discharge temperature. Range is -20 to +120°F.
14	VAPORIZER ON INDICATOR L-1	Indicates, when lit, that vaporizer is on.
15	STOP SWITCH PB-1	Controls pump and vaporizer operation. Depress to stop.
16	START SWITCH PB-2	Controls pump and vaporizer operation. Depress to start.

TABLE 1. CONTROLS AND INDICATORS (CONT)

Item No. (Figure 1)	Control/Indicator	Function
17	COMPARTMENT LIGHT SWITCH SS-1 ON-OFF	Controls compartment light operation.
18	VACUUM INDICATOR VP-3	Indicates tank annulus vacuum. 0 to 1000 microns Hg. Normal indication is less than 100 microns.
19	FILL AND TRANSFER VALVE V-1	Controls liquid flow into storage tank.
20	SERVICING LINE VALVE V-2	Controls liquid outflow during transfer of liquid from tank.
21	VACUUM PROBE VALVE V-3	Controls tank annulus vacuum indication on VP-3.
22	TANK VENT VALVE V-4	Controls tank pressure vent to atmosphere.
23	PRESSURE BUILDUP VALVE V-5	Controls liquid flow to pressure buildup coil.
24	PUMP VAPOR RETURN VALVE V-6	Controls liquid flow through the pump and vapor return to storage tank.
25	TANK LEVEL GAGE VALVE V-7 (3-way)	Controls tank liquid level indication on G-1.
26	FULL TRYCOCK VALVE V-8	Open during tank filling operation to insure complete filling of tank (when liquid overflows).
27	LOW PRESSURE BLEED VALVE V-9	Controls low pressure line bleed to aid cooldown and pump prime.
28	HIGH PRESSURE BLEED VALVE V-10	Controls high pressure line bleed to provide easier pump starting.
29	EVACUATION VALVE V-11	Controls evacuation of tank annulus pressure.
30	PUMP SUCTION VALVE V-12	Controls liquid flow to pump for cooldown and gas conversion.
31	FILL VALVE V-13	Controls liquid flow into storage tank.

TABLE 1. CONTROLS AND INDICATORS (CONT)

Item No. (Figure 1)	Control/Indicator	Function
32	FILL LINE RELIEF VALVE RV-4	Controls pressure relief in fill line.
33	LIQUID SERVICING LINE RELIEF VALVE RV-5	Controls pressure relief in liquid servicing line.
34	ADJUSTABLE GAS DISCHARGE TEMPERATURE CONTROLLER TC-1	Controls gas discharge temperature by set point. Adjustable range +30° to +100°F. Factory set at +70°F.

5. PREOPERATIONAL CHECKOUT.

6. Prior to operating system, perform preparation for use procedures, refer to WP 004 00 and perform preoperational checkout in accordance with the Preoperational Checklists, NAVAIR 19-600--206-6-1 and NAVAIR 19-600-207-6-1.

7. OPERATING PROCEDURES.

8. The operator must be familiar with all operating controls, instruments and indicators prior to operating the system.

WARNING

Refer to NAVAIR 06-30-501 and NAVAVNLOGCENINST 10332.1 for instructions and precautions to observe when handling cryogenic liquids.

9. TANK FILLING. To fill storage tank proceed as follows:

a. Connect supply source to fill connection C-1. Open tank vent valve V4.

NOTE

On initial filling of a warm tank, large volumes of gas will evolve.

b. Open supply source valve, fill valve V-13 and fill and transfer valve V-1 to start liquid transfer.

c. Open high and low pressure ports and close equalizing port of valve V-7.

CAUTION

Do not overfill tank. When filling tank to maximum capacity, always open full trycock valve V-8 to prevent overfilling.

d. When liquid level reaches 2000 gallons, maximum, as observed on gage G-1 or by liquid overflowing through full trycock line, or any other desired level, close fill and transfer valve V-1. Leave tank vent valve V-4 partially open to prevent excessive pressure buildup in storage tank.

e. Close source supply valve and pull lever on relief valve RV-4 to drain fill line.

f. Disconnect supply source. Close fill valve V-13, vent valve V-4 and full trycock valve V-8.

NOTE

Storage tank may also be filled through alternate liquid transfer connection C-8. This connection allows for permanent connection with another storage tank.

10. PRESSURE BUILDUP. To build tank pressure required for draining the storage tank or transferring liquid out of it, proceed as follows:

a. Close vent valve V-4 and open pressure buildup valve V-5. Observe TANK PRESSURE GAGE G-2.

b. Close valve V-5 when desired pressure is obtained.

11. LIQUID SERVICING. To transfer liquid out of tank, proceed as follows:

a. Momentarily open valve V-2 to purge hose (until liquid flows).

b. On oxygen system, connect LIQUID SERVICING CONNECTION C-2 attached to liquid servicing hose C-3, to the fill connection of the receiving vessel with a liquid fill hose to connection C-4.

c. In order to allow liquid transfer, build up tank pressure, refer to paragraph 10, until tank pressure is sufficiently higher than tank pressure of receiving vessel.

d. Open fill valve on receiving vessel and servicing line valve V-2. Transfer liquid. Close valve V-2 and fill valve on receiving tank after completion of liquid transfer.

e. Pull lever on relief valve RV-5 and drain line. Disconnect receiving vessel from connection C-2 or C-4 as applicable.

NOTE

The storage tank cannot be drained completely through the liquid servicing line since it terminates in a stand pipe 6 inches above the bottom of the inner tank. To completely drain the storage tank, refer to paragraph 12.

12. TANK DRAINING. To drain storage tank, proceed as follows:

a. Connect receiving vessel with a liquid fill hose to connection C-1.

b. Build up tank pressure, refer to paragraph 10, until tank pressure is sufficiently higher than pressure of receiving vessel.

c. Open fill valve on receiving vessel, valves V-13 and V-1. Transfer liquid until storage tank is fully drained.

d. Close fill valve V-13 and fill valve on receiving vessel. Pull lever on relief valve RV-4 and drain line. Close fill and transfer valve V-1. Disconnect receiving vessel from connection C-1.

13. HIGH PRESSURE GAS DELIVERY. To operate the converter system in the gas delivery mode, proceed as follows:

a. Connect high pressure gas receiver to HIGH PRESSURE GAS DISCHARGE CONNECTION C-5.

b. Open pump suction valve V-12 and pump vapor return line valve V6.

NOTE

When valve V-6 is open, pressure will increase. Adjustment of valve V-5 may not be required. If tank pressure, gage G-2, exceeds 50 psig, bleed pressure by opening vent valve V-4.

c. Maintain vessel pressure of 5 to 50 psig by opening pressure buildup valve V-5 as required.

d. Set gas pressure discharge switch PS-1 for pressure of gas discharge. TC-1 is located in the electrical control box and is factory set at 70°F. The control for PS-1 is the control knob located in pump discharge pressure gage.

e. Open LOW PRESSURE BLEED valve V-9 and HIGH PRESSURE BLEED valve V-10 to cool down pump.

f. When pump cooldown is complete (approximately 10 to 15 minutes after liquid is admitted, and is indicated by heavy frost buildup on the pump cold end and a steady stream of liquid venting from valves V-9 and V-10), close V-9 and depress start switch PB-2 to start pumping operation.

NOTE

If pump prime cannot be established, stop pump operation and allow additional cool down time.

g. Close high pressure bleed valve V-10 slowly. At this point, pump prime should be indicated by discharge pressure rise on pressure gage G-4.

NOTE

If ambient temperature is below +30°F, low temperature safety switch TS-1 will open preventing pump and vaporizer operation with normal start-up procedures. Depress start switch PB-2 and hold (approximately 30 seconds) until vaporizer has warmed sufficiently to close TS-1. Converter system operation may now proceed normally.

h. The system will continue to operate until receiving vessel reaches pressure setting on GAS PRESSURE DISCHARGE SWITCH PS-1 and automatically shuts off or until STOP SWITCH PB-1 is depressed.

14. CONVERTER SYSTEM SHUTDOWN. Proceed as follows:

CAUTION

Upon completion of shutdown, ensure all vent and bleed valves are open for at least three minutes to ensure that all lines are free of liquid.

a. Depress STOP SWITCH PB-1.

b. Close valves V-6 and V-12. Open valves V-9 and V-10. Maintain in open condition for a minimum of three minutes.

c. Close valves V-9 and V-10.

d. Disconnect receiving vessel connection.

15. VACUUM INDICATOR (VP-3) OPERATION. To read tank annulus vacuum level, proceed as follows:

a. Make certain that the two "D" size batteries are installed and operational.

b. Ensure that VACUUM INDICATOR VP-3 connector is securely connected to thermocouple vacuum probe VP-1 in tank annulus.

c. Zero adjust meter pointer by holding toggle switch in the ADJUST position. Rotate adjust knob until pointer is directly over the "0" micron position on the right hand of the meter dial.

d. While holding switch in the ON position, open vacuum probe valve V-3. Allow 15 seconds for circuit stabilization and read the vacuum.

e. After measurements are complete, close valve V-3 and release toggle switch to the OFF position.

16. PURGING/LOX WASH. Purge and LOX wash the tank in accordance with NAVAVNLOGCENINST 10332.1

OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(INTERMEDIATE AND DEPOT)

TESTING AND TROUBLESHOOTING

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

This WP supersedes WP 006 00, dated 1 April 1983

Reference Material

Periodic Maintenance Requirement Cards (Cryogenic Service System)	NAVAIR 19-600-206-6-2
Periodic Maintenance Requirement Cards (Storage Tank Assembly)	NAVAIR 19-600-207-6-2
Preoperational Checklist (Cryogenic Service System)	NAVAIR 19-600-206-6-1
Preoperational Checklist (Storage Tank Assembly)	NAVAIR 19-600-207-6-1

Alphabetical Index

Record of Applicable Technical Directives

None

1. TESTING.

2. Testing consists of an operational check of the system. Prior to operating the system, perform preoperational checkout, refer to Preoperational Checklists, NAVAIR 19-600-206-6-1 and NAVAIR 19-600-207-6-1. Operate system in accordance with WP 005 00.

3. TROUBLESHOOTING.

4. To troubleshoot system in the event of abnormal operation, refer to Table 1. Refer to Figures 2 and 3 of WP 003 00, wiring diagram and flow schematic, as aids to troubleshooting.

Table 1. Troubleshooting

Trouble	Probable Cause	Remedy
Pump motor does not start	1. Defective control fuse FU-1.	Check and replace. Refer to WP 009 00.
	2. Circuit wiring not compatible with external power source.	Check and rewire, refer to WP 009 00.
	3. Electrical components (T-1, MS-1 or CR-1) defective.	Check and replace. Refer to WP 009 00.
	4. Defective motor.	Repair/replace. Refer to WP 009 00 and 012 00.
	5. Defective high temperature safety switch TS-2.	Replace if switch is open below +185°F. Refer to WP 009 00.
	6. Defective low temperature safety switch TS-1.	Replace if switch is open above +30°F. Refer to WP 009 00.
	7. Defective gas discharge pressure switch PS-1.	Replace if switch is closed at pressure below setpoint. Refer to WP 009 00.
Pump does not prime	1. Liquid is heat saturated.	Vent tank and repressurize. Refer to WP 005 00.
	2. Pump inlet strainer (ST-1) clogged.	Clean or replace strainer. Refer to WP 009 00.
	3. Insufficient cooldown time.	Repeat cooldown procedure. Refer to WP 005 00.
Pump cavitating; indicated by fluctuating discharge pressure and/or rattling noise from pump	1. Pump vapor return valve V-6 not open far enough.	Slowly open valve V-6. If cavitation continues, slowly open low pressure bleed valve V-9 until pump primes, then close valve.
	2. Insufficient liquid sub cooling.	Increase liquid tank pressure refer to WP 005 00.

Table 1. Troubleshooting (cont)

Trouble	Probable Cause	Remedy
Converter system shuts off before reaching correct pressure setting	1. Defective pressure switch PS-1.	Replace. Refer to WP 009 00.
	2. Motor overloads tripped.	Reset, check that motor, belt-drive and pump rotate freely, and refer to WP 009 00.
	3. Vaporizer defective (gas discharge temperature below +30°F).	Replace. Refer to WP 009 00.
	4. Defective pump (gas discharge temperature above +185°F due to no flow).	Check/replace. Refer to WP 009 00.
	5. Defective fuse FU-1	Check and replace. Refer to WP 009.00.
Relief valves RV-1, RV-2, RV-3, RV-4 and/or RV-5 hiss	Worn relief valve seat.	Replace relief valve. Refer to WP 008 00 and 009 00.
Unable to build tank pressure	Vent line pressure regulator R-1 misadjusted or defective.	Adjust to 50 psig or replace, refer to WP 008 00.
Manual hand valves inoperative	Valve frozen.	Thaw valve with water and dry with warm, dry nitrogen gas.
Excessive tank venting through RV-1 or R-1	1. Relief valve RV-1 and/or vent line pressure regulator misadjusted or defective.	Adjust/replace, refer to WP 008 00.
	2. Tank insulation defective or tank damaged.	Check tank annulus vacuum level and pump down if required. Replace insulation or repair tank, refer to WP 008 00.

Table 1. Troubleshooting (cont)

Trouble	Probable Cause	Remedy
Tank annulus vacuum indication (VP-3) not normal	1. Defective valve V3 or vacuum probe VP-1.	Replace defective component. Refer to WP 009 00.
	2. Defective or misadjusted vacuum indicator VP-3.	Check batteries, adjust or repair indicator. Refer to WP 010 00.

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

CRYOGENIC SERVICE SYSTEM
OXYGEN, PART NUMBER 160021-1
NITROGEN, PART NUMBER 160021-3

Reference Material

Aviators Breathing Oxygen (ABO) Surveillance Program	NAVAVNLOGCENINST 10332.1
Liquid Oxygen Cleaning Requirements	MIL-C-52211
Oxygen/Nitrogen Cryogenic Systems	NAVAIR 06-30-501

Alphabetical Index

Record of Applicable Technical Directive

None

1. GENERAL MAINTENANCE.

WARNING

Refer to NAVAIR 06-30-501 and NAVAVNLOG-CENINST 10332.1 for information concerning handling of Oxygen/ Nitrogen Cryogenic systems.

2. SCHEDULED MAINTENANCE. Perform periodic maintenance of the tank and converter systems in accordance with NAVAIR 19-600-206-6-2 and NAVAIR 19-600-207-6-2.

3. INSPECTION.

a. Inspect all parts for distortion, cracks and damage.

b. Inspect lines for leaks, dents, cracks, etc.

c. Inspect line insulation for open seams, breaks, damage etc.

d. Refer to WP 008 00 for detailed inspection requirements for tank assembly.

e. Refer to WP 009 00 for detailed inspection requirements for converter.

4. CLEANING.

Materials Required

Nomenclature	Spec/Part No.
Solvent	MIL-C-81302

WARNING

Use cleaning solvent in well-ventilated area. Avoid prolonged breathing of fumes and excessive contact with skin. Keep solvent away from open flames. Use approved safety equipment. Do not direct compressed oil free nitrogen at personnel.

CAUTION

Do not use compressed oil free nitrogen over 15 psi for blowing parts/ components dry.

CAUTION

All parts which come in contact with liquid oxygen must be certified "CLEANED FOR OXYGEN SERVICE", refer to MIL-C-52211. These items are identified in the illustrated parts breakdown description column as /LOX CLEAN/.

a. Remove exterior dirt and grease by wiping with cloth dampened with solvent MIL-C-81320. Clean interior parts/components with solvent per MIL-C-81320.

b. Allow parts to air dry after cleaning.

c. Using compressed oil free nitrogen, blow out dirt in cracks, crevices etc.

5. CONVERTER SYSTEM ASSEMBLY. (Figure 1.)

WARNING

Due to weight and bulk, use a suitable lifting device (fork-lift) to remove converter as a unit.

6. REMOVAL. Removal of individual converter components is provided in WP 009 00. To remove the converter (1) as a complete unit, proceed as follows:

a. Disconnect all electrical and cryogenic connections, refer to WP 009 00.

b. Remove screws (2), nut (3) and washers (4). Remove converter (1).

7. INSTALLATION.

a. Install converter (1) and secure with screws (2), nuts (3) and washers (4).

b. Connect electrical and cryogenic connections, refer to WP 009 00.

8. TANK ASSEMBLY. (Figure 1.)

9. REMOVAL. Removal of tank assembly (5, 6) components is provided in WP 008 00.

10. INSTALLATION. Installation of tank assembly (5, 6) components is provided in WP 008 00.

11. FILL AND VAPOR LINES. (Figure 1.)

Materials Required

Nomenclature	Spec/Part No.
Adhesive	#520 Armstrong Cement (Pameco-Aire)
Paint	White, Armaflex finish Armstrong White (Pameco-Aire)

12. REMOVAL. Remove insulation (26, 27) around liquid fill line (12) in order to gain access to attachment points. Proceed as follows:

a. Remove applicable attaching parts (13 through 16 and 19 through 24). Remove lines (12, 18) at attachment points.

b. Remove nameplate (10, 11) by removing valve (17, 25) handle nuts.

13. INSTALLATION.

a. Install lines (12, 18). Secure with attaching parts (13 through 16 and 19 through 24).

Note

Insulation seams covering liquid fill line (12) are to be longitudinal and 180° apart.

b. Install insulation (26) over liquid fill line (12). Bond seams watertight with #520 Armstrong adhesive. Then over insulation (26), install insulation (27). Bond seams watertight with #520 Armstrong adhesive.

c. After insulation (26, 27) seams have cured for a minimum of 24 hours, apply a coat of Armaflex finish Armstrong white paint. Allow paint to dry.

d. Install nameplates (10, 11) using valve (17, 25) handle nuts.

14. ILLUSTRATED PARTS BREAKDOWN.

15. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 1 for illustrated parts breakdown and group assembly parts list (GAPL).

16. Usable on codes applicable to this WP are:

A Part No. 160021-1
B Part No. 160021-3

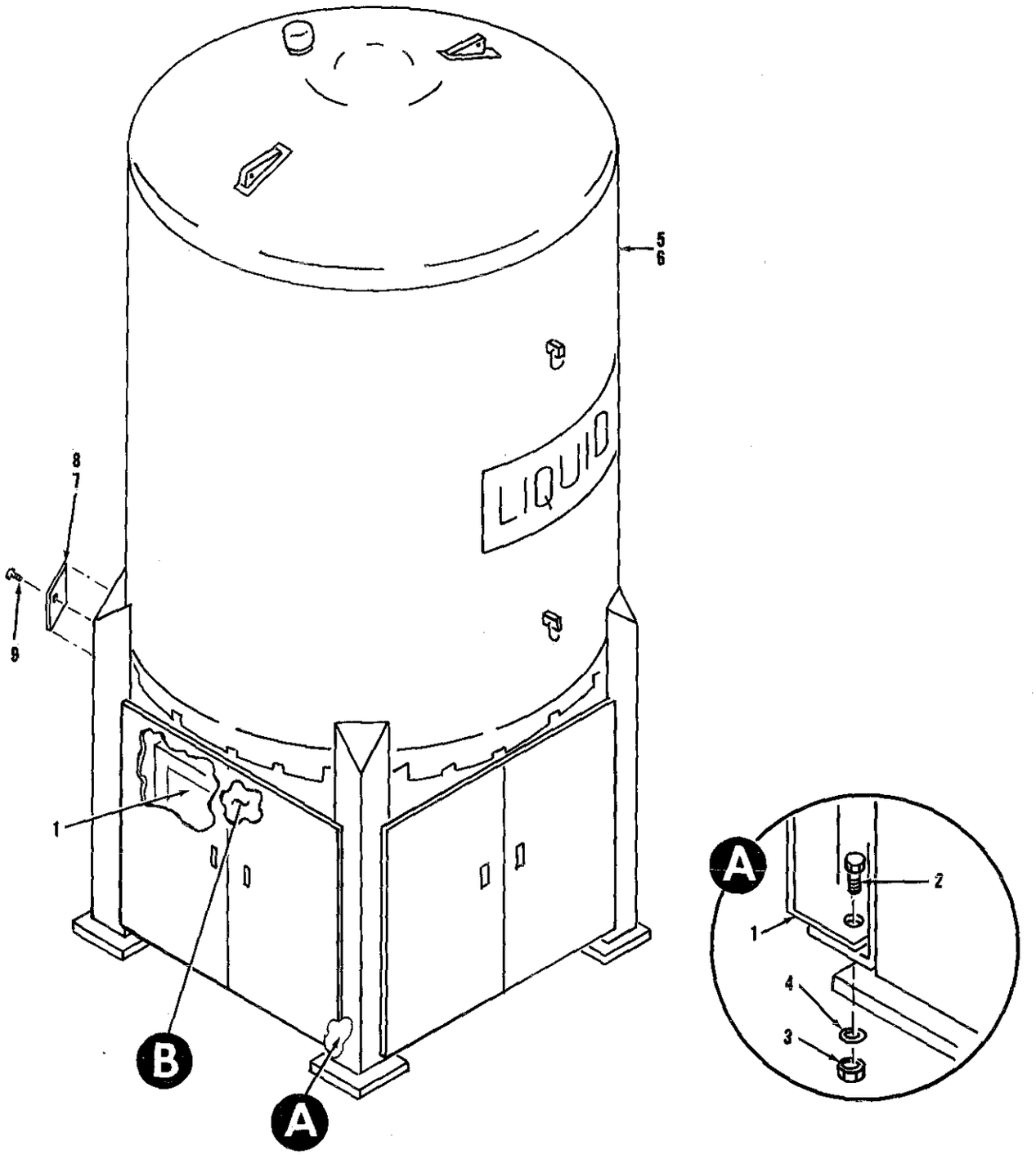


Figure 1. Cryogenic Service System (Sheet 1 of 4)

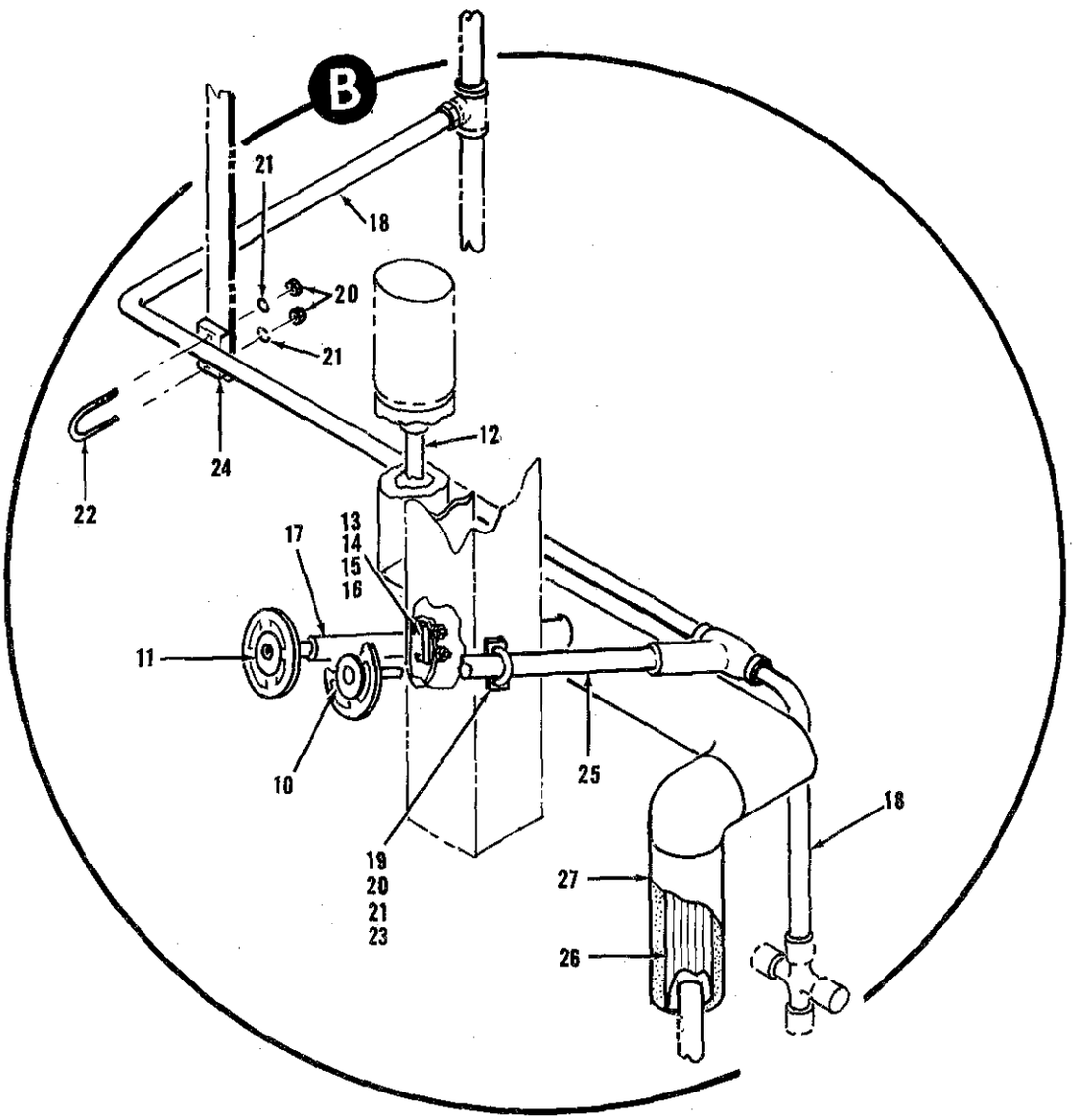


Figure 1. Cryogenic Service System (Sheet 2)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	160021-1	SERVICE SYSTEM, CRYOGENIC, . . LIQUID OXYTEN A/F26A-2/ LOX CLEAN/	REF		PEHHD
	160021-3	SERVICE SYSTEM, CRYOGENIC, . . LIQUID NITROGEN A/F26A-1 LOX CLEAN/	REF		PEHHD
1	160041-1	.CONVERTER SYSTEM ASSY/REFER . . TO WP 009 00 FOR DETAILS/ LOX CLEAN/ /ATTACHING PARTS/	1		PAHHD
2	MS90725-113	.SCREW	4		PAHZZ
3	MS51967-14	.NUT	4		PAHZZ
4	MS35338-48	.WASHER	4		PAHZZ
		---*---			
5	160001-1	.TANK ASSY/REFER TO WP 008 00 . . FOR DETAILS/LOX CLEAN/	1	A	PEHHD
6	160001-3	.TANK ASSY/REFER TO WP 008 00 . . FOR DETAILS/LOX CLEAN/	1	B	PEHHD
7	160013-3	.NAMEPLATE	1	A	XBHZZ
8	160013-1	.NAMEPLATE	1	B	XBHZZ
		/ATTACHING PARTS/			
9	MS21318-21	.DRIVE SCREW	4		PAHZZ
		---*---			
10	160053-23	.NAMEPLATE/V-6/	1		XBHZZ
11	160053-25	.NAMEPLATE/V-12/	1		XBHZZ
12	160016-1	.FILL LINE, LIQUID/LOX CLEAN/ . . /ATTACHING PARTS/	1		XBHZZ
13	2601299-5	.U-BOLT/11243/	1		XBHZZ
14	MS51967-2	.NUT	2		PAHZZ
15	MS35338-44	.WASHER	2		PAHZZ
16	160007-29	.INSULATOR	1		XBHZZ
		---*---			
17	701872X48	..VALVE/REFER TO WP 011 00 . . FOR DETAILS/48422/V12/ LOX CLEAN/	1		XBHHH
18	160016-3	.RETURN LINE, VAPOR/LOX CLEAN/ . . /ATTACHING PARTS/	1		XBHHH
19	2601299-5	.U-BOLT/11243/	1		XBHZZ
20	MS51967-2	.NUT	4		PAHZZ
21	MS35338-44	.WASHER	4		PAHZZ
22	2601299-3	.U-BOLT/11243/	1		XBHZZ
23	160007-29	.INSULATOR	1		XBHZZ
24	160007-31	.INSULATOR	1		XBHZZ
		---*---			

Figure 1. Cryogenic Service System (Sheet 3)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
25	701872X48	..VALVE/REFER TO WP 011 00 FOR DETAILS/48422/V6/ LOX CLEAN/	1		XBHHH
26	805	.INSULATION/PAMECO-AIRE, 700 DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
27	819	.INSULATION/PAMECO-AIRE, 700 DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ

Figure 1. Cryogenic Service System (Sheet 4)

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

TANK ASSEMBLY
PART NUMBER 160001-1 AND 160001-3

List of Effective Work Package Pages

Page No	Chg No	Page No	Chg No	Page No	Chg No	Page No	Chg No
1	1	2 thru 9	0	10	1	11 thru 14	0

Reference Material

Aviators Breathing Oxygen (ABO) Surveillance Program . . . . . NAVAVNLOGCENINST 10332.1
Oxygen/Nitrogen Cryogenic Systems . . . . . NAVAIR 06-30-501

Alphabetical Index

Record of Applicable Technical Directives

None

1. GENERAL MAINTENANCE.

WARNING

Refer to NAVAIR 06-30-501 and NAVAVNLOG-CENINST 10332.1 for information concerning handling of Oxygen/ Nitrogen Cryogenic systems.

2. INSPECTION. (Figure 1.)

a. Inspect all parts for distortion, cracks and damage.

b. Inspect lines for leaks, dents, and damage.

c. Inspect insulation for open seams, breaks or damage.

d. Inspect doors and latches for proper opening, closing and securing operations.

e. Refer to WP 011 00 for detailed inspection requirements for valves (30, 32, 43, 53, 64, 67 and 86).

f. Refer to WP 010 00 for detailed inspection requirements for vacuum indicator (97).

g. Inspect nameplate (131 through 139, 141 through 152) and decals (156, 157) for legibility and secure attachment.

h. Inspect pressure build up coil (121) for breaks, cracks or damage.

i. Inspect gages (95, 96) for broken/cracked glass or bent indicator arms.

3. CLEANING. Refer to WP 007 00 for detailed cleaning requirements.

4. REPAIR. Repair is essentially limited to the replacement of defective part/component. Welded parts may be repaired using standard welding techniques. Minor damage to pressure build up coil can be accomplished using standard soldering techniques.

5. TRANSFER HOSE. (Figure 1.)

6. REMOVAL.

a. Remove hose (1) by disconnecting hose and unlatching latches (9). Remove parts (2 through 5) as required.

b. Remove clamps (6, 7) by removing screws (8).

c. Remove toggle latches (9) by removing screws (10).

7. INSTALLATION.

a. Install toggle latches (9) using screws (10).

b. Install clamps (6, 7) using screws (8).

c. Install parts (2 through 5) as required. Connect hose (1) and secure with latches (9) and clamps (6, 7).

8. DOORS/ACCESSORIES. (Figure 1.)

9. REMOVAL.

a. Remove holder assembly (11), clip assembly (12) and bracket assembly (13) only if replacement is required.

b. Remove handle (14) by removing screws (15) and nuts (16).

c. Remove dead bolt lock (17) by removing screws (18) and nuts (19).

d. Remove doors (20, 21) by removing screws (22).

10. INSTALLATION.

a. Install doors (20, 21) using screws (22).

b. Install dead bolt lock (17) using screws (18) and nuts (19).

c. Install handle (14) using screws (15) and nuts (16).

d. Install holder assembly (11), clip assembly (12) and bracket assembly (13) using standard welding techniques.

11. LINES AND TUBE ASSEMBLIES. (Figure 1.)

Materials Required

Nomenclature	Spec/Part No.
Adhesive	#520 Armstrong Cement (Pameco-Aire)
Paint	Armaflex finish Armstrong white Pameco-Aire)

12. REMOVAL.

Note

Remove insulation (158, 159, 160) and insulation tape (161) as required from line (45).

a. Remove lines (23, 36, 45, 57, 69) as required by removing applicable attaching parts.

b. Remove fitting assembly (73) and tube assemblies (79, 90, 91, 92, 93, 94) as required.

13. INSTALLATION.

a. Install tube assemblies (79, 90, 91, 92, 93, 94). Install fitting assembly (73).

b. Install lines (23, 36, 45, 57, 69) using applicable attaching parts.

c. Install two layers of insulation (158, 159, 160) and insulation tape (161) on line (45). Bond all seams watertight with #520 Armstrong adhesive.

Note

Filter (54) shall have only one layer of insulation with only one longitudinal seam bonded watertight with #520 Armstrong adhesive. End seams shall not be bonded together but wrapped and bonded watertight to tape (161) using #520 Armstrong adhesive.

d. After insulation bonding has cured for a minimum of 24 hours, apply Armaflex finish Armstrong white paint on insulation. Allow paint to dry.

14. INDICATORS. (Figure 1.)

15. REMOVAL.

a. Remove pressure gages (95, 96).

b. Remove vacuum indicator (97). Refer to WP 010 00 for detailed maintenance instructions.

Note

To avoid losing tank vacuum, do not remove vacuum probe (100).

16. INSTALLATION.

a. Install vacuum indicator (97).

b. Install pressure gages (95, 96).

17. PRESSURE BUILD UP COIL. (Figure 1.)

18. REMOVAL.

a. Remove coil (121) by removing screws (122), nuts (123) and washers (124).

19. INSTALLATION.

a. Install coil (121) using screws (122), washers (124) and nuts (123).

20. ILLUSTRATED PARTS BREAKDOWN.

21. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 1 for illustrated parts breakdown and group assembly parts list (GAPL).

22. Usable on codes applicable to this WP are:

A Part No. 160001-1
B Part No. 160001-3

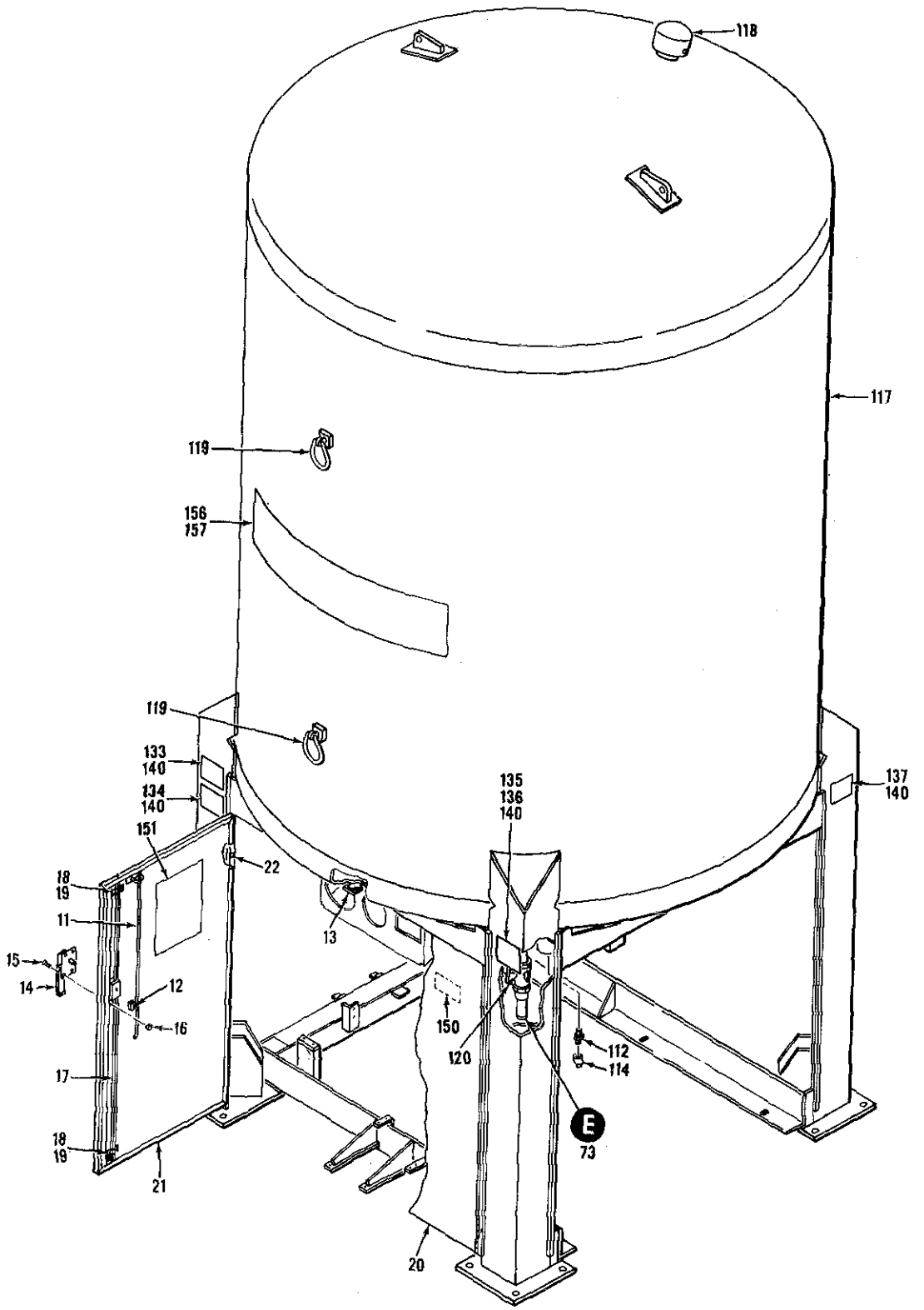


Figure 1. Tank Assembly (Sheet 1 of 9)

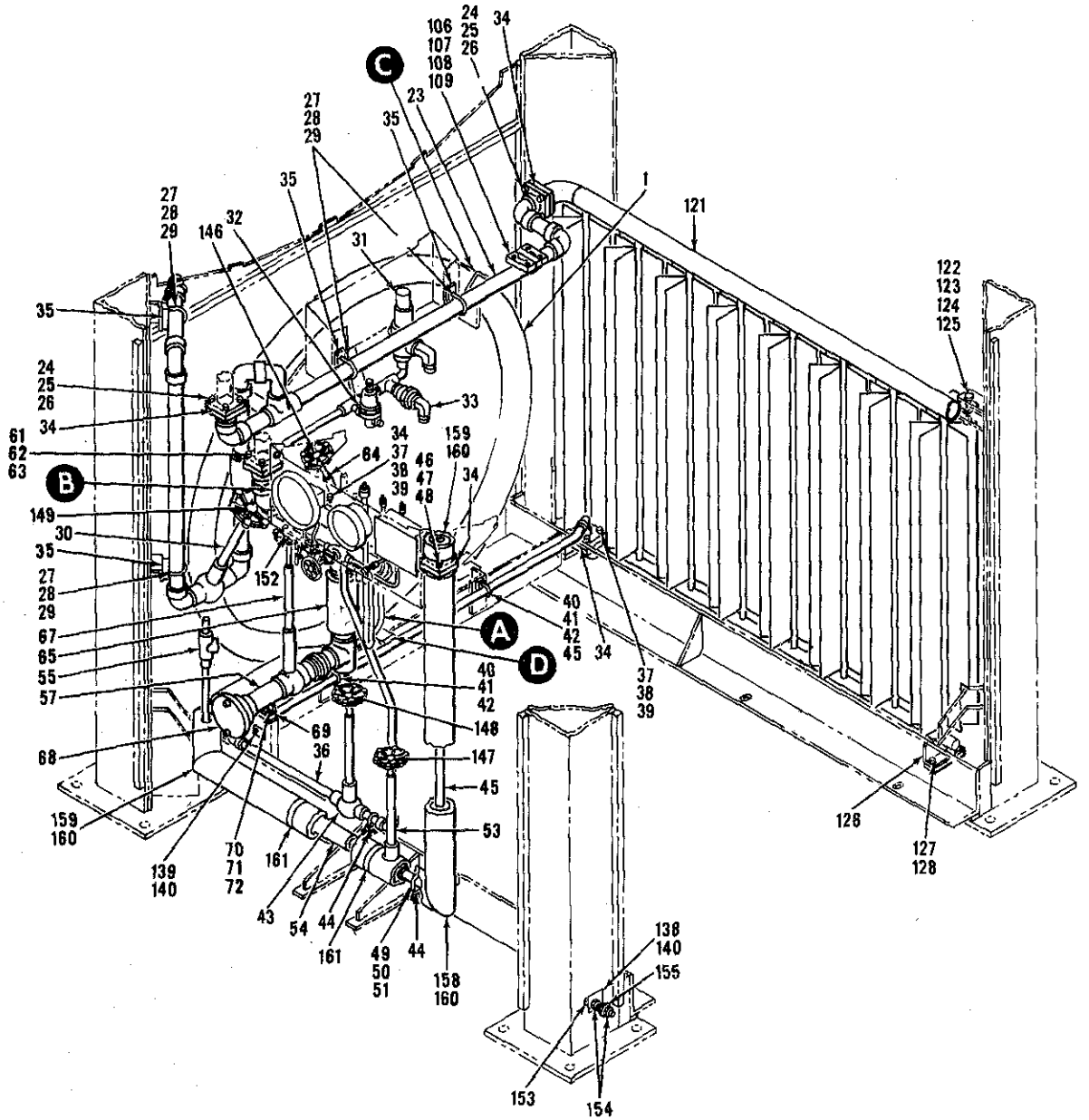


Figure 1. Tank Assembly (Sheet 2)

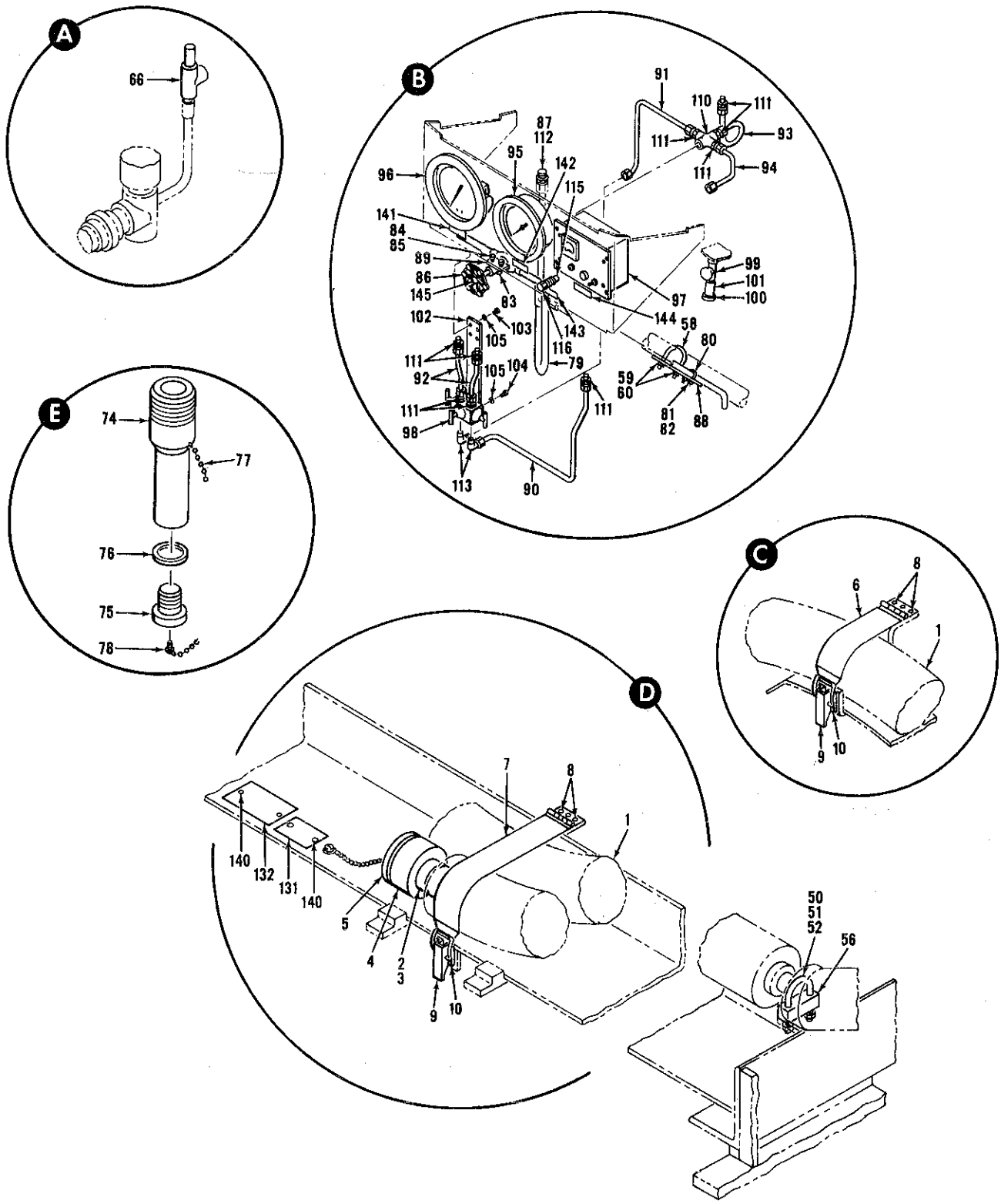


Figure 1. Tank Assembly (Sheet 3)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	160001-1	TANK ASSY/REFER TO WP 007 00 FOR NHA/LOX CLEAN/ . .	REF		PEHHD
	160001-3	TANK ASSY/REFER TO WP 007 00 FOR NHA/LOX CLEAN/ . .	REF		PEHHD
1	59C6671-2-15	.HOSE, TRANSFER/C3/14727/LOX CLEAN/ . .	1	A	PAHZZ
2	160001-P60	.NIPPLE/C2 CONNECTION/	1	A	PAHZZ
3	49A3919	.NUT/98750/C2 CONNECTION/	1	A	PAHZZ
4	49A3820	.CONNECTOR/98750/C2 CONNECTION/ .	1	A	PAHZZ
5	52A3751	.CAP/98750/C2 CONNECTION/	1	A	PAHZZ
6	160007-1	.CLAMP, UPPER	2		XBHZZ
7	160007-3	.CLAMP, LOWER . . . . . /ATTACHING PARTS/	1		XBHZZ
8	MS24584-24	.SCREW . . . . . ---*---	9		PAHZZ
9	TL-800-B	.LATCH, TOGGLE/72794/ . . . . . /ATTACHING PARTS/	3		PAHZZ
10	MS24584-24	.SCREW . . . . . ---*---	12		PAHZZ
11	160007-21	.HOLDER ASSY, DOOR	6		XBDZZ
12	160007-23	.CLIP ASSY	6		XBDZZ
13	160007-25	.BRACKET ASSY	3		XBDZZ
14	160007-7	.HANDLE. . . . . /ATTACHING PARTS/	6		PAHZZ
15	MS24584-57	.SCREW	24		PAHZZ
16	MS35650-302	.NUT . . . . . ---*---	24		PAHZZ
17	5611-82X	.LOCK, DEAD BOLT/73685/ . . . . . /ATTACHING PARTS/	6		PAHZZ
18	MS24584-55	.SCREW	24		PAHZZ
19	MS35650-302	.NUT . . . . . ---*---	24		PAHZZ
20	160007-5	.DOOR	3		XBDZZ
21	160007-6	.DOOR . . . . . /ATTACHING PARTS/	3		XBDZZ
22	MS24629-45	.SCREW . . . . . ---*---	48		PAHZZ

Figure 1. Tank Assembly (Sheet 4)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
23	160005-3	.VENT LINE/LOX CLEAN/ . . . . . /ATTACHING PARTS/	1		XBHHH
24	MS35307-417	.SCREW	8		PAHZZ
25	MS51967-8	.NUT	8		PAHZZ
26	AN960-816	.WASHER	8		PAHZZ
27	2601299-33B	.U BOLT	4		PAHZZ
28	MS51967-8	.NUT	8		PAHZZ
29	MS35338-46	.WASHER . . . . . ---*---	8		PAHZZ
30	701872X56	..VALVE, TANK VENT/V4/48422/ . . REFER TO WP 011 00 FOR DETAILS/LOX CLEAN/	1		PAHHH
31	190418-1	..VALVE, RELIEF/RV1/LOX CLEAN/ . .	1		PAHHZ
32	3/8-FRM-2	..VALVE, REGULATING/R1/71342/ . . REFER TO WP 011 00 FOR DETAILS/LOX CLEAN/	1		PAHHH
33	UA-2-1-3000	..DISC ASSY, BURST/BD1/32874/ . .	1		PAHHH
34	190105-1	.GASKET	6		PAHZZ
35	160007-13	.INSULATOR	4		XBDZZ
36	160005-5	.LIQUID LINE/LOX CLEAN/ . . . . . /ATTACHING PARTS/	1		XBHHH
37	MS35307-417	.SCREW	8		PAHZZ
38	MS51967-8	.NUT	8		PAHZZ
39	AN960-816	.WASHER	8		PAHZZ
40	2601299-13B	.U BOLT	3		PAHZZ
41	MS51967-2	.NUT	6		PAHZZ
42	MS35338-44	.WASHER ---*---	6		PAHZZ
43	701872X52	..VALVE, PRESSURE BUILD UP/V5/ . . 48422/REFER TO WP 011 00 FOR DETAILS/LOX CLEAN/	1		PAHHH
44	160007-9	.INSULATOR	4		PAHZZ
45	160006-3	.SERVICE LINE/LOX CLEAN/ . . . . . /ATTACHING PARTS/	1		XBHHH
46	MS35307-417	.SCREW	4		PAHZZ
47	MS51967-8	.NUT	4		PAHZZ
48	AN960-816	.WASHER	4		PAHZZ

Figure 1. Tank Assembly (Sheet 5)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
49	2601299-13B	.U BOLT	1		PAHZZ
50	MS51967-2	.NUT	4		PAHZZ
51	MS35338-44	.WASHER	4		PAHZZ
52	2601299-17B	.U BOLT	1		PAHZZ
		---*---			
53	701872X52	..VALVE, SERVICE/V2/48442/ . . REFER TO WP 011 00 FOR DETAILS/LOX CLEAN/	1		PAHHH
54	552AS134-1	.. FILTER/F3/14487/LOX CLEAN/ . .	1		PAHZZ
55	190418-3	..VALVE, RELIEF/RV5/LOX CLEAN/ . .	1		PAHZZ
56	160007-11	.INSULATOR	1		PAHZZ
57	160006-1	.FILL LINE/LOX CLEAN/ . . . . . /ATTACHING PARTS/	1		XBHHH
58	2601299-33B	.U BOLT	1		PAHZZ
59	MS51967-8	.NUT	2		PAHZZ
60	AN960-616	.WASHER	2		PAHZZ
61	MS35307-417	.SCREW	4		PAHZZ
62	MS51967-8	.NUT	4		PAHZZ
63	AN960-816	.WASHER	4		PAHZZ
		---*---			
64	701842X64	..VALVE, FILL AND TRANSFER/V1/ . . 48422/REFER TO WP 011 00 FOR DETAILS/LOX CLEAN/	1		PAHHH
65	552AS134-2	.. FILTER/F4/14487/LOX CLEAN/ . .	1		PAHZZ
66	190418-5	..VALVE, RELIEF/RV4/LOX CLEAN/ . .	1		PAHZZ
67	700375X64	..VALVE, FILL/V13/48422/REFER TO WP 011 00 FOR DETAILS/ LOX CLEAN/	1		PAHHH
68	C8991180	..COUPLING ASSY/C1/	1		XBHZZ
69	160007-15	.INSULATOR/FILL LINE/ . . . . . /ATTACHING PARTS/	1		PAHZZ
70	MS35307-363	.SCREW	2		PAHZZ
71	MS51967-8	.NUT	2		PAHZZ
72	MS35338-46	.WASHER	2		PAHZZ
		---*---			
73	160007-19	.FITTING ASSY, VACUUM	1		PAHHH
74	160007-P24	..FITTING	1		PAHZZ
75	160007-P25	..PLUG	1		PAHZZ
76	160007-P29	..GASKET	1		PAHZZ

Figure 1. Tank Assembly (Sheet 6)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
77	160007-P34	..COUPLING	1		PAHZZ
		/ATTACHING PARTS/			
78	MS35233-12	..SCREW	1		PAHZZ
		---*---			
79	160006-5	.TUBE ASSY/LOX CLEAN/	1		XBHHH
		/ATTACHING PARTS/			
80	2601299-3B	.U BOLT	1		PAHZZ
81	MS51967-2	.NUT	2		PAHZZ
82	MS35338-44	.WASHER	2		PAHZZ
83	2601299-7B	.U BOLT	1		PAHZZ
84	MS51967-14	.NUT	2		PAHZZ
85	AN960-816	.WASHER	2		PAHZZ
		---*---			
86	1872	..VALVE/V8/48422/REFER TO . .	1		PAHHH
		WP 011 00 FOR DETAILS/			
		LOX CLEAN/			
87	180459-25	..NIPPLE	1		PAHZZ
88	160007-27	.BRACKET	1		XBHZZ
89	160007-33	.INSULATOR	1		PAHZZ
90	160006-13	.TUBE ASSY/LOX CLEAN/	1		PAHZZ
91	160006-15	.TUBE ASSY/LOX CLEAN/	1		PAHZZ
92	160006-17	.TUBE ASSY/LOX CLEAN/	2		PAHZZ
93	160006-19	.TUBE ASSY/LOX CLEAN/	1		PAHZZ
94	160006-21	.TUBE ASSY/LOX CLEAN/	1		PAHZZ
95	522AS143-1	.GAGE, PRESSURE/G2/30003/LOX . .	1		PAHZZ
		CLEAN/			
96	190405	.GAGE, LIQUID LEVEL/G1/11243/ . .	1		PAHZZ
97	2200901-1	.INDICATOR, VACUUM/VP3/11243/ . .	1		PAHHH
		REFER TO WP 010 00 FOR			
		DETAILS/LOX CLEAN/			
98	M2T/BRASS + P4 =(3)B1	.VALVE, 3 WAY/V7/88773/LOX . .	1		PAHZZ
99	190406-1	.VALVE, VACUUM PROBE/V3/LOX . .	1		PADZZ
		CLEAN/			
100	2200902-1	.PROBE, VACUUM/VP1/11243/	1		PAHZZ
101	160001-P59	.REDUCER, COUPLING	1		PAHZZ
102	160007-35	.BRACKET	1		XBHZZ
		/ATTACHING PARTS/			
103	MS24584-55	.SCREW	4		PAHZZ
104	MS24584-59	.SCREW	2		PAHZZ
105	MS35338-43	.WASHER	6		PAHZZ
		---*---			

Figure 1. Tank Assembly (Sheet 7)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
106	180110-13	.FLANGE	1		XBHZZ
		/ATTACHING PARTS/			
107	MS35307-417	.SCREW	4		PAHZZ
108	MS51967-8	.NUT	4		PAHZZ
109	AN960-816	.WASHER	4		PAHZZ
		---*---			
110	160001-P61	.CROSS	1		PAHZZ
111	4-4FTX-B	.NIPPLE/45681/	9		PAHZZ
112	10-FTX-B	.NIPPLE/45681/	2		PAHZZ
113	4-4-CTX-B	.ELBOW/45681/	2		PAHZZ
114	10-FNTX-B	.CAP ASSY/45681/	1		PAHZZ
115	4-WTX-B	.UNION, BULKHEAD/45681/	1		PAHZZ
116	4-FNTX-B	.CAP ASSY/45681/	1		PAHZZ
117	160004-1	.TANK/LOX CLEAN/	1		XBDDD
118	180444-1	.HEAD, SAFETY	1		PADDD
119	5016	..RING, TIE DOWN/53913/	4		PAHZZ
120	2600765-1	..VALVE, VACUUM/V11/11243/ . .	1		PADDD
121	160005-1	.COIL, PRESSURE BUILD UP/LOX CLEAN/ . .	1		PBHDD
		/ATTACHING PARTS/			
122	MS35307-418	.SCREW	1		PAHZZ
123	MS51967-14	.NUT	1		PAHZZ
124	MS35338-48	.WASHER	1		PAHZZ
		---*---			
125	160001-P102	.SPACER	1		PAHZZ
126	160005-7	.INSULATOR	1		PAHZZ
		/ATTACHING PARTS/			
127	160001-P80	.SCREW	2		PAHZZ
128	AN960-616	.WASHER	2		PAHZZ
		---*---			
129	DELETED				
130	DELETED				
131	160003-1	.NAMEPLATE	1		XBHZZ
132	160003-25	.NAMEPLATE	1		XBHZZ
133	160003-29	.NAMEPLATE	1		XBHZZ
134	160003-27	.NAMEPLATE	1		XBHZZ

Figure 1. Tank Assembly (Sheet 8)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
135	160003-33	.NAMEPLATE	1	A	XBHZZ
136	160003-35	.NAMEPLATE	1	B	XBHZZ
137	3300042-1	.NAMEPLATE/11243/	1		XBHZZ
138	160003-23	.NAMEPLATE	1		XBHZZ
139	160003-13	.NAMEPLATE . . . . . /ATTACHING PARTS/	1		XBHZZ
140	MS21318-21	.SCREW . . . . . ---*---	26		PAHZZ
141	160003-5	.NAMEPLATE	1		XBHZZ
142	160003-7	.NAMEPLATE	1		XBHZZ
143	160003-9	.NAMEPLATE	1		XBHZZ
144	160003-11	.NAMEPLATE	1		XBHZZ
145	160003-21	.NAMEPLATE	1		XBHZZ
146	160003-13	.NAMEPLATE	1		XBHZZ
147	160003-15	.NAMEPLATE	1		XBHZZ
148	160003-19	.NAMEPLATE	1		XBHZZ
149	160003-17	.NAMEPLATE	1		XBHZZ
150	160003-31	.NAMEPLATE	1		XBHZZ
151	160003-5	.NAMEPLATE	1		XBHZZ
152	160003-37	.NAMEPLATE	1		XBHZZ
153	MS35307-419	.SCREW (GND)	1		PAHZZ
154	MS51967-14	.NUT (GND)	3		PAHZZ
155	AN960-816	.WASHER (GND)	2		PAHZZ
156	190420-3	.DECAL, LIQUID OXYGEN	1	A	PAHZZ
157	190420-1	.DECAL, LIQUID NITROGEN	1	B	PAHZZ
158	613	.INSULATION/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
159	415	.INSULATION/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
160	819	.INSULATION/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
161	9584	.TAPE, INSULATION/PAMECO-AIRE, . . 700 DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ

Figure 1. Tank Assembly (Sheet 9)

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

CONVERTER SYSTEM ASSEMBLY
PART NUMBER 160041-1

Reference Material

Aviators Breathing Oxygen (ABO) Surveillance Program	NAVAVNLOGCENINST 10332.1
Oxygen/Nitrogen Cryogenic Systems	NAVAIR 06-30-501

Alphabetical Index

Record of Applicable Technical Directive

None

1. GENERAL MAINTENANCE.

WARNING

Refer to NAVAIR 06-30-501 and NAVAVNLOG-CENINST 10332.1 for information concerning handling of Oxygen/Nigrogen Cryogenic systems.

2. INSPECTION. (Figure 1.)

a. Inspect all parts for distortion, cracks and damage.

b. Inspect all tube assemblies for leaks, dents and damage.

c. Inspect electrical components/wiring for evidence of shorting or arcing. Inspect wiring for frayed insulation.

d. Inspect gearbelt (118) for damage, wear or loose tension. Gearbelt must not exceed 3/16 inch midpoint delfection with a ten pound force applied at mid point.

e. Inspect gages (135, 136) for broke/cracked glass or bent indicator arms.

f. Inspect nameplates for legibility and secure attachment.

g. Inspect insulation for open seams, breaks or damage.

3. CLEANING. Refer to WP 007 00 for detailed cleaning requirements.

4. REPAIR. Repair is limited to the replacement of defective part/component.

5. CONTROL BOX. (Figure 1.)

Note

All electrical wires must be tagged prior to removing to aid in installation.

6. REMOVAL.

a. Remove pilot light assembly components (24 through 27) as required.

b. Remove selector switch assembly components (29 through 31) as required.

c. Remove switch assembly components (33, 34, 36, 37) as required.

d. Remove compartment light components (43, 44, 45) and light bulb (46) as required.

e. Remove remainder of control box components as required.

f. Remove enclosure assembly (79) by removing screws (21), nuts (22) and washers (23).

7. INSTALLATION.

Note

After installation of electrical components, wire component referring to Figure 2, WP 003 00 for schematic diagram.

a. Install enclosure assembly (79) using screws (21), washers (23) and nuts (22).

b. Install control box components as required.

8. MOTOR/PUMP AND DRIVE COMPONENTS. (Figure 1.)

9. REMOVAL .

a. Remove belt cover (84) by removing screws (85) and washers (86).

b. Remove gearbelt (118) by loosening nut (82) and belt tensioner (81) until sufficient slack exists to remove belt from pulleys (119, 120).

Note

All electrical wires must be tagged prior to removing to aid in installation.

c. Disconnect wiring and conduit connection to motor (123).

d. Remove motor (123) by removing bolts (4).

e. Remove pump (125) by removing bolts (126) and nuts (127).

f. Remove pulleys (119, 120) and bushings (121, 122) if replacement is required.

10. INSTALLATION.

a. Install bushings (121, 122) and pulleys (119, 120) onto motor (123) and pump (125).

b. Install pump (125) using bolts (126) and nuts (127). Do not tighten bolts.

c. Install motor (123) using bolts (124). Do not tighten bolts.

d. Loosen nut (82) and belt tensioner (81). Install gear belt (118) onto pulleys (119, 120). Adjust in accordance with paragraph 11.

e. After adjustment, tighten bolts (126, 124), nut (82) and belt tensioner (81).

f. Connect electrical connections/conduit to motor (123). Refer to Figure 2, WP 003 00 for correct connections.

g. Install belt cover (84) using screws (85) and washers (86).

11. ADJUSTMENT.

a. Using a straight edge ruler, check for parallelism of pulleys (119, 120). If not parallel, move motor (123) and/or pump (125) until pulleys are parallel, then tighen bolts (124, 126).

b. With nut (82) loosened, adjust gearbelt (118) tension by adjusting belt tensioner (81) until midpoint belt defection is 3/16 inch with a 10 pound force applied at belt midpoint. After adjustment is complete, tighten nut (82).

c. Momentarily start motor and observe belt travel. Check motor rotation, refer to WP 004 00. If belt travel is not smooth in pulley (119, 120) grooves, shut down motor and readjust pulley parallelism, step a above. Repeat until belt travel is correct.

12. GAGES. (Figure 1.)

Materials Required

Nomenclature	Spec/Part No.
Adhesive	#520 Armstrong Cement (Pameco-Aire)
Paint	Armaflex finish Armstrong white Pameco-Aire)

13. REMOVAL.

a. Remove pressure switch gage (134) and pressure gage (135).

b. Remove insulation (165, 166) from around thermal bulb of temp gage (136) and tube assembly (115).

c. Remove tape (167, 168) securing thermal bulb to tube assembly (115).

d. Remove temp gage (136) along with connected thermal bulb.

14. INSTALLATION.

a. Install temp gage (136). Secure thermal bulb to tube assembly (115) with tape (168). Insulate thermal bulb and tube assembly (115) with four wraps of tape (167).

b. Install one layer each of insulation (165, 166) around tube assembly (115) and thermal bulb with longitudinal seams 180° apart. Bond seams watertight using #520 Armstrong adhesive. After adhesive has cured for a minimum of 24 hours, apply Armaflex finish, Armstrong white paint on insulation (165, 166). Allow paint to dry.

c. Install pressure switch gage (134) and pressure gage (135).

15. INSULATION INSTALLATION. (Figure 1.)

Materials Required

Nomenclature	Spec/Part No.
Adhesive	#520 Armstrong Cement (Pameco-Aire)
Paint	Armaflex finish Armstrong white Pameco-Aire)

a. Install one layer each of insulation (165, 166) around applicable tube assemblies with longitudinal seams 180° apart.

b. Bond all seams watertight using #520 Armstrong adhesive.

c. After adhesive has cured for a minimum of 24 hours, apply Armaflex finish, Armstrong white paint on insulation. Allow paint to dry.

16. ILLUSTRATED PARTS BREAKDOWN.

17. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 1 for illustrated parts breakdown and group assembly parts list (GAPL).

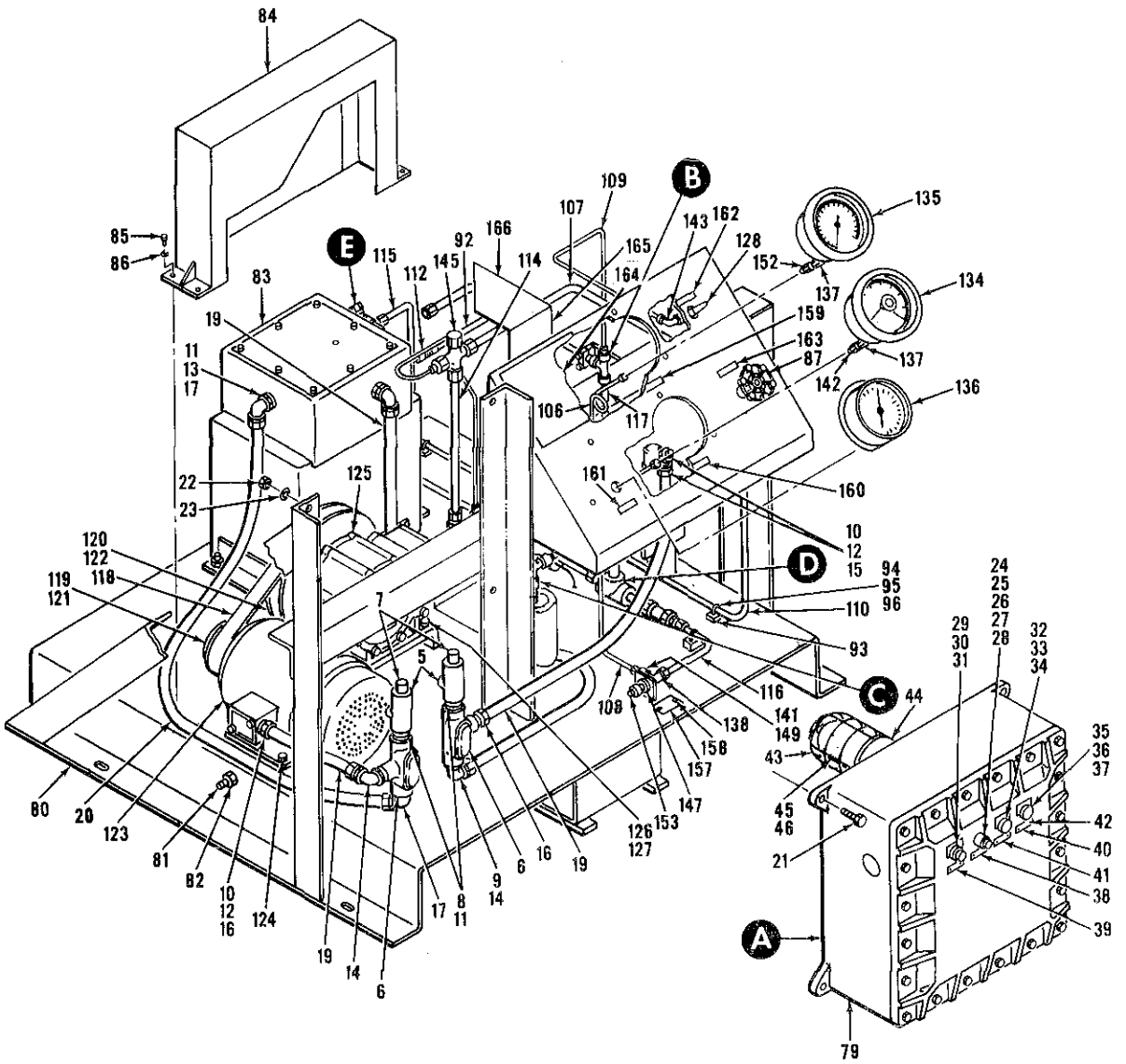


Figure 1. Converter System Assembly (Sheet 1 of 8)

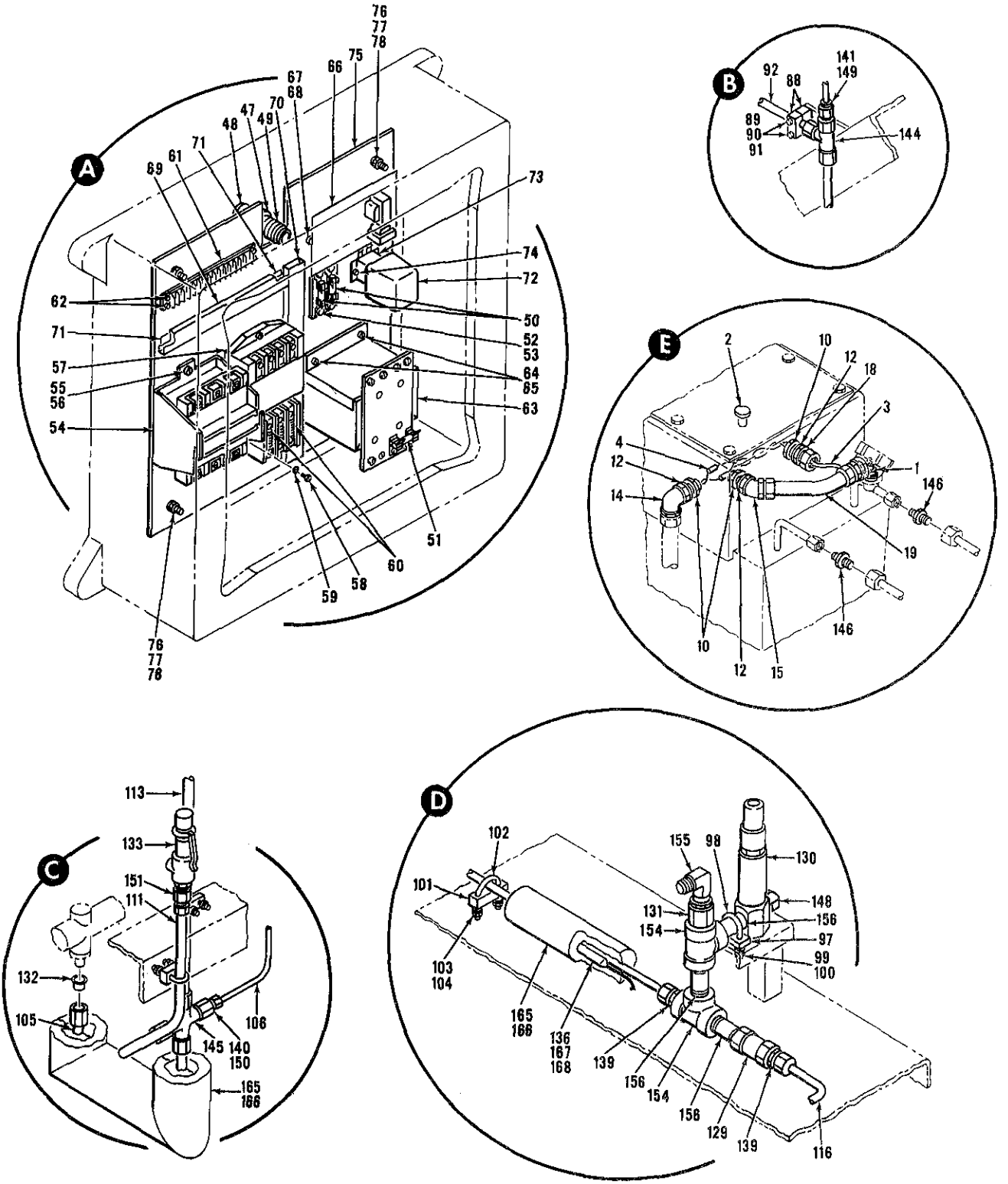


Figure 1. Converter System Assembly (Sheet 2)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	160041-1	CONVERTER SYSTEM ASSY/REFER TO . . WP 007 00 FOR NHA/LOX CLEAN/	REF		PAHHD
	160042-1	.ELECTRICAL INSTL	1		XBHHH
1	190282-1	..THERMOSTAT/TS1/	1		PAHZZ
2	180007-1	..PROBE ASSY/TS2/	1		XBHHH
3	190357-1	..SENSOR, TEMP/TE1/	1		PAHZZ
4	2RA18	..SPLICE, BUTT/59730/	1		PAHZZ
5	EYS21	..SEAL/20558/	2		PAHZZ
6	T-217	..BODY, CONDUIT/20558/	2		XBHZZ
7	160042-P8	..NIPPLE	2		PAHZZ
8	160042-P9	..NIPPLE	2		PAHZZ
9	601	..REDUCER/59730/	1		PAHZZ
10	141	..LOCKNUT/59730/	6		PAHZZ
11	142	..LOCKNUT/59730/	5		PAHZZ
12	5262	..SEAL, RING/59730/	5		PAHZZ
13	5263	..SEAL, RING/59730/	1		PAHZZ
14	5252	..CONNECTOR/59730/	3		PAHZZ
15	5242	..CONNECTOR/59730/	2		PAHZZ
16	5232	..CONNECTOR/59730/	3		PAHZZ
17	5253	..CONNECTOR/59730/	2		PAHZZ
18	2520	..CONNECTOR/59730/	1		PAHZZ
19	UA 1/2	..CONDUIT/14016/	AR		PAHZZ
20	US 3/4	..CONDUIT/14016/	AR		PAHZZ
	160045-1	.CONTROL BOX . . . . . /ATTACHING PARTS/	1		PAHHH
21	MS90725-163	.SCREW	4		PAHZZ
22	MS51967-20	.NUT	4		PAHZZ
23	MS35338-50	.WASHER . . . . . ---*---	4		PAHZZ
	190412-1	..LITE ASSY, PILOT/AMBER/L1/ . . . /ATTACHING PARTS/	1		PAHHH
24	142	..LOCKNUT/59730/ . . . . . ---*---	1		PAHZZ
25	FA2305-36	...BASE/58675/	1		XBHZZ
26	B33507502	...LOCKNUT/58675/	1		PAHZZ
27	FA2306-4	...LENS/58675/	1		PAHZZ
28	190413-1	..BULB/L1/	1		PAHZZ
	190414-1	..SWITCH ASSY, SELECTOR/SS1/ . . . /ATTACHING PARTS/	1		PAHZZ
29	142	..LOCKNUT/59730/ . . . . . ---*---	1		PAHZZ

Figure 1. Converter System Assembly (Sheet 3)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
30	FA2286-1L	...SWITCH/58675/SS1/	1		XAHZZ
31	B260020	...BLOCK/58675/	1		XAHZZ
	190416-1	..SWITCH ASSY/PB2/	1		PAHZZ
		/ATTACHING PARTS/			
32	142	..LOCKNUT/59730/	1		PAHZZ
		---*---			
33	B26002030	...BLOCK/58675/	1		XAHZZ
34	FA2321-1B0	...BUTTON/58675/PB2/	1		XAHZZ
	190417-1	..SWITCH ASSY/PB1/	1		PAHZZ
		/ATTACHING PARTS/			
35	142	..LOCKNUT/59730/	1		PAHZZ
		---*---			
36	B26002020	...BLOCK/58675/	1		XAHZZ
37	FA2321-1R0	...BUTTON/58675/PB1/	1		XAHZZ
38	160053-5	..NAMEPLATE	1		XAHZZ
39	160053-7	..NAMEPLATE	1		XAHZZ
40	160053-1	..NAMEPLATE	1		XAHZZ
41	160053-3	..NAMEPLATE	1		XAHZZ
		/ATTACHING PARTS/			
42	MS21318-21	..SCREW	8		PAHZZ
		---*---			
	190415-1	..COMPARTMENT, LIGHT/L2/	1		XBHHH
43	V911	...GUARD/20558/	1		XBHZZ
44	VXHA119	...BODY/20558/	1		XBHZZ
45	V-75	...GLOBE/20558/L2/	1		PAHZZ
46	75A21/RF	..BULB, LIGHT/24455/	1		PAHZZ
47	141	..LOCKNUT/59730/	1		PAHZZ
48	160045-P32	..NIPPLE	1		XBHZZ
49	422	..SLEEVE/59730/	1		XBHZZ
50	190403-3	..FUSE/FU2/1 AMP/	2		PAHZZ
51	190386-9	..FUSE/FU1/5 AMP/	1		PAHZZ
52	190332-1	..BLOCK, FUSE	1		PAHZZ
		/ATTACHING PARTS			
53	MS35223-32	..SCREW	2		PAHZZ
		---*---			
54	190026-1	..CONTACTOR/C1/	1		PAHZZ
		/ATTACHING PARTS			
55	MS35224-66	..SCREW	3		PAHZZ
56	MS35333-39	..WASHER	3		PAHZZ
		---*---			

Figure 1. Converter System Assembly (Sheet 4)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
57	190256-5	..STARTER, MOTOR/MS1/ . . . . . /ATTACHING PARTS	1		PAHZZ
58	MS35224-66	..SCREW	2		PAHZZ
59	MS35333-39	..WASHER . . . . . ---*---	2		PAHZZ
60	190302-15	..HEATER/OL1/USED FOR 480V . . OPERATION/	3		PAHZZ
	190302-17	..HEATER/OL1/USED FOR 240V . . OPERATION/	3		PAHZZ
61	CR151020112	..BOARD TERMINAL/93199/ . . . . . /ATTACHING PARTS/	1		XBHZZ
62	MS35223-32	..SCREW . . . . . ---*---	4		PAHZZ
63	190039-7	..TRANSFORMER/T1/ . . . . . /ATTACHING PARTS/	1		PAHZZ
64	MS35224-66	..SCREW	4		PAHZZ
65	MS35333-39	..WASHER . . . . . ---*---	4		PAHZZ
66	190369-1	..CONTROLLER, TEMP/TC1/ . . . . . /ATTACHING PARTS/	1		PAHZZ
67	MS35223-32	..SCREW	2		PAHZZ
68	MS35333-37	..WASHER . . . . . ---*---	2		PAHZZ
69	160045-P22	..DUCT, WIRE	1		XAHHH
70	160045-P21	..DUCT, WIRE . . . . . /ATTACHING PARTS/	1		XAHHH
71	190404-1	..FASTENERS, FOAM . . . . . ---*---	5		PAHZZ
72	190350-1	..RELAY/CR1/	1		PAHZZ
73	190351-1	..BASE, RELAY-OCTAL . . . . . /ATTACHING PARTS/	1		XBHZZ
74	MS35223-34	..SCREW . . . . . ---*---	2		PAHZZ
75	160045-P2	..PANEL . . . . . /ATTACHING PARTS/	1		XBDZZ
76	MS35649-2252	..NUT	12		PAHZZ
77	MS35338-44	..WASHER	12		PAHZZ
78	160045-P37	..ROD, THREADED . . . . . ---*---	12		XBHZZ

Figure 1. Converter System Assembly (Sheet 5)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
79	1F18186	..ENCLOSURE ASSY	1		XBDZZ
80	160046-1	.BASE, WELDMENT	1		XBHDD
81	160048-3	..BELT TENSIONER	1		PAHZZ
82	MS51967-23	..NUT	2		PAHZZ
83	160047-1	.VAPORIZER/VA1/HTR1/	1		PAHDD
84	160048-7	.COVER, BELT	1		XBHZZ
		/ATTACHING PARTS/			
85	MS35307-306	.SCREW	4		PAHZZ
86	MS35338-44	.WASHER	4		PAHZZ
		---*---			
87	1872	.VALVE, LOW PRESS BLEED/V9/ . .	1		PAHHH
		48422/ REFER TO WP 011 00			
		FOR DETAILS/LOX CLEAN/			
88	160048-11	.INSULATOR	2		XBHZZ
		/ATTACHING PARTS			
89	MS35234-71	.SCREW	2		PAHZZ
90	MS35650-304	.NUT	2		PAHZZ
91	MS35338-138	.WASHER	2		PAHZZ
		---*---			
92	160049-23	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
93	160048-15	.INSULATOR	5		XBHZZ
		/ATTACHING PARTS			
94	2601299-3B	.U BOLT/11243/	5		XBHZZ
95	MS51971-1	.NUT	10		PAHZZ
96	MS35338-139	.WASHER	10		PAHZZ
		---*---			
97	160048-17	.INSULATOR	2		XBHZZ
		/ATTACHING PARTS			
98	2601299-7B	.U BOLT/11243/	2		XBHZZ
99	MS51971-1	.NUT	4		PAHZZ
100	MS35338-139	.WASHER	4		PAHZZ
		---*---			
101	160048-13	.INSULATOR	2		XBHZZ
		/ATTACHING PARTS			
102	2601299-1B	.U BOLT/11243/	2		XBHZZ
103	MS51971-1	.NUT	4		PAHZZ
104	MS35338-139	.WASHER	4		PAHZZ
		---*---			
105	160049-1	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
106	160049-3	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
107	160049-5	.TUBE ASSY/LOX CLEAN/	1		XBHZZ

Figure 1. Converter System Assembly (Sheet 6)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
108	160049-7	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
109	160049-9	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
110	160049-13	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
111	160049-15	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
112	160049-17	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
113	160049-19	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
114	160049-21	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
115	160049-25	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
116	160049-27	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
117	160049-29	.TUBE ASSY/LOX CLEAN/	1		XBHZZ
118	480H150	.GEARBELT/71198/	1		PAHZZ
119	30HP150	.PULLEY/71198/	1		XBHZZ
120	72HQ150	.PULLEY/71198/	1		XBHZZ
121	P1X1 1/8	.BUSHING/71198/	1		XBHZZ
122	Q1X1 1/4	.BUSHING/71198/	1		XBHZZ
123	190411-1	.MOTOR/M1/REFER TO WP 012 00 FOR DETAILS/ /ATTACHING PARTS . .	1		PAHHH
124	MS90725-87	.BOLT. . . . . ---*---	4		PAHZZ
125	2312801-21	.PUMP/P1/11243/MODEL CL-1D-75/ LOX CLEAN/ /ATTACHING PARTS . .	1		PAHDD
126	MS90725-114	.BOLT.	4		PAHZZ
127	MS51967-14	.NUT . . . . . ---*---	4		PAHZZ
128	7115H4S	.VALVE, BLEED/V10/28968/LOX CLEAN/ . .	1		PAHZZ
129	2333B-4PP	.VALVE, CHECK/CV1/27409/LOX CLEAN/ . .	1		PAHZZ
130	5333B-4PP-6000	.VALVE, RELIEF/RV3/27409/LOX CLEAN/ . .	1		PAHZZ
131	552AS125-1	.DISC, BURST/BD2/30003/LOX CLEAN .	1		PAHZZ
132	552AS141-1	.STRAINER/ST1/30003/LOX CLEAN . .	1		PAHHH
133	190418-3	.VALVE, RELIEF/RV2/LOX CLEAN . . .	1		PAHZZ
134	552AS144-1	.PRESSURE SWITCH-GAGE/G4/30003/ LOX CLEAN/ .	1		PAHZZ
135	552AS143-1	.PRESSURE GAGE/G3/30003/	1		PAHZZ
136	190409-1	.TEMP GAGE-THERMOMETER/G5/LOX CLEAN/ . .	1		PAHZZ
137	190410-1	.DAMPENER, PULSATION/SN2/LOX CLEAN/ . .	2		PAHZZ

Figure 1. Converter System Assembly (Sheet 7)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
138	AN904-8J	.TEE, BULKHEAD	1		PAHZZ
139	AN816-8-8J	.NIPPLE	2		PAHZZ
140	10BTX-B	.NUT, COUPLING/45681/	2		PAHZZ
141	AN818-8J	.NUT, COUPLING	2		PAHZZ
142	4-4GTX-SS	.CONNECTOR, FEMALE/45681/	1		PAHZZ
143	MS20822-4-4J	.ELBOW	2		PAHZZ
144	AN824-8J	.TEE	1		PAHZZ
145	AN827-10J	.CROSS	2		PAHZZ
146	AN919-12J	.REDUCER	2		PAHZZ
147	AN924-8J	.NUT, BULKHEAD	1		PAHZZ
148	MS20822-8-8J	.ELBOW	1		PAHZZ
149	8-4TRTX-SS	.REDUCER/45681/	2		PAHZZ
150	10-4RTX-B	.REDUCER/45681/	2		PAHZZ
151	10GTX-B	.CONNECTOR, FEMALE/45681/	1		PAHZZ
152	4-4GTX-B	.CONNECTOR, FEMALE/45681/	1		PAHZZ
153	AN929-8J	.CAP ASSY	1		PAHZZ
154	160041-P69	.TEE	2		XBHZZ
155	160041-P70	.ELBOW	1		XBHZZ
156	160041-P71	.NIPPLE	3		XBHZZ
157	160053-9	.NAMEPLATE . . . . . /ATTACHING PARTS/	1		XBHZZ
158	MS21318-21	.SCREW . . . . . ---*---	2		PAHZZ
159	160053-11	.NAMEPLATE	1		XBHZZ
160	160053-13	.NAMEPLATE	1		XBHZZ
161	160053-15	.NAMEPLATE	1		XBHZZ
162	160053-17	.NAMEPLATE	1		XBHZZ
163	160053-19	.NAMEPLATE	1		XBHZZ
164	160053-21	.NAMEPLATE	1		XBHZZ
165	806	.INSULATION/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
166	819	.INSULATION/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
167	9584	.TAPE, INSULATION/PAMECO-AIRE, . . 700 DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ
168	162	.TAPE, BACKED/PAMECO-AIRE, 700 . . DUBUQUE AVE., SOUTH SAN FRANCISCO, CA/	AR		PAHZZ

Figure 1. Converter System Assembly (Sheet 8)

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

VACUUM INDICATOR
PART NUMBER 2200901-1

Reference Material

None

Alphabetical Index

Record of Applicable Technical Directive

None

Support Equipment Required

Nomenclature	Part No.
Diffuser Pump	Welch 1400BQ
Multimeter	Simpson 260
Vacuum Test Meter	Hastings VT-513
Vacuum Probes (2)	2200902-1 (Cosmodyne)
Vacuum Probe Valves (2)	190406-1 (Cosmodyne)
Vacuum Chamber	5 Microns Hg psi minimum

Materials Required

Nomenclature	Spec/Part No.
Glyptol	7461-M (General Cement)
Solvent	MIL-C-81302

Note

Equivalent substitute items may be used.

1. DISASSEMBLY. (Figure 3.)

CAUTION

When pulling panel (1) away from chassis (19), use caution not to damage or pull on electric connections.

Note

All electrical wires must be tagged prior to removing to aid in assembly.

a. Remove screws (2) and carefully pull panel (1) away from chassis (19). Remove knob (4) if resistor (6) is to be removed. Remove batteries (21).

b. Remove panel mounted components; resistors (5, 6) and switch (9) by disconnecting electrical connections and removing applicable nuts (7, 10) and lockwashers (8). Remove lugs (11) if replacement is required.

c. Remove meter (13) and terminal strip (12) by disconnecting electrical connections and removing applicable attaching parts.

d. Remove resistors (14, 15). Do not remove nuts (3), connector (16), cable (17), grommet (18) and battery holder (20) unless replacement is required.

2. CLEANING. Refer to WP 007 00 for detailed cleaning procedures.

3. INSPECTION.

a. Inspect electrical wiring for signs of fraying, shorting, arcing or loose connections.

b. Inspect battery terminals for corrosion, cleanliness and security of fit in battery holder.

c. Inspect meter panel for broken or scratched glass and/or bent pin indicator.

d. Inspect switch and variable resistors for ease of movement, binding etc.

4. ASSEMBLY. (Figure 3.)

Note

When replacing electrical components, refer to Figure 1 for correct wiring.

a. Install battery holder (20), grommet (18), cable (17), connector (16) and/or nuts (3) if replacement was required.

b. Install terminal strip (12), meter (13) and switch (9) to panel (1) using nuts (10) and applicable attaching parts. Install lugs (11) to switch (9).

c. Install variable resistors (5, 6) to panel (1). Secure with nuts (8) and lockwashers (7). Install resistors (14, 15).

d. Make all electrical connections referring to Figure 1. Coat meter terminals after connection with Glyptol. Install batteries (21) observing battery polarity position marked on holder (20).

e. Carefully push panel (1) into chassis (19). Secure panel (1) with screws (2). Install knob (4).

5. ADJUSTMENT. (Figure 2.)

a. Connect indicator and probes in setup, refer to Figure 2. Zero adjust meter pointer by rotating ADJ control. Zero position is the first thin line at the extreme left of dial (not ATMO line).

b. Place and hold toggle switch in ADJ position.

Note

The toggle switch is spring-loaded to the OFF position.

c. Rotate ADJ control until pointer indicates 0 microns (extreme right scale indication).

d. Place and hold toggle switch in ON position. Indicator meter should duplicate reading of test meter.

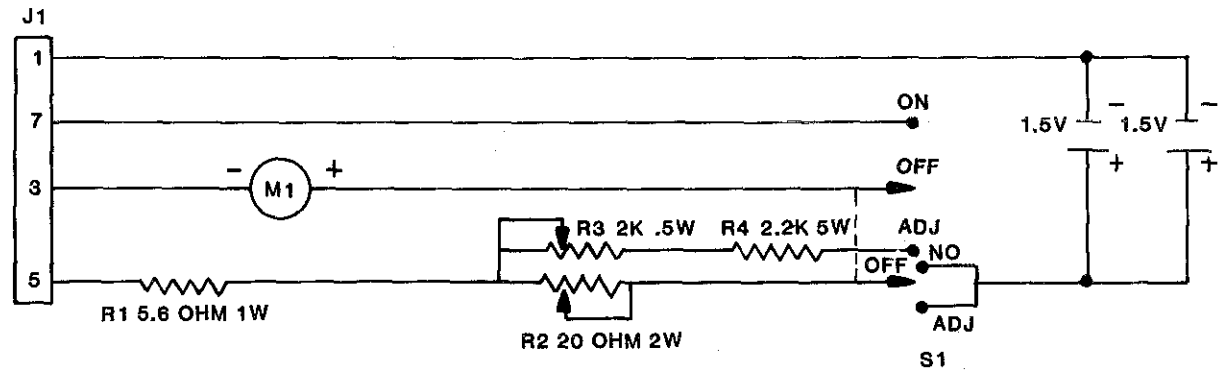
Note

Tap meter lightly after each adjustment to ensure pointer is operating freely.

e. If indicator does not duplicate test meter, turn CALIBRATE control until pointer shows correct indication.

f. Release toggle switch to OFF position. Meter pointer should return to zero position. If meter does not indicate zero, readjust, refer to step a.

g. Adjust indicator to 0 microns in accordance with steps b and c.



NOTE: ALL WIRE IS 22AWG STRANDED.

Figure 1. Indicator Schematic

h. Adjust test meter reading in accordance with steps d and e.

j. Repeat steps d through h until indicator duplicates test meter reading.

k. Adjust vacuum level to 90 - 100 microns Hg absolute on test meter scale. Indicator shall duplicate reading or be adjusted to this indication in accordance with steps a through j.

l. After accomplishing all adjustments, pot slotted CALIBRATE screw with Glyptol.

6. TESTING.

7. Testing of the indicator is limited to performing adjustment, paragraph 8. If indicator cannot be adjusted, use multimeter to fault isolate malfunctions of indicator referring to Figure 1.

8. ILLUSTRATED PARTS BREAKDOWN.

9. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 3 for illustrated parts breakdown and group assembly parts list (GAPL).

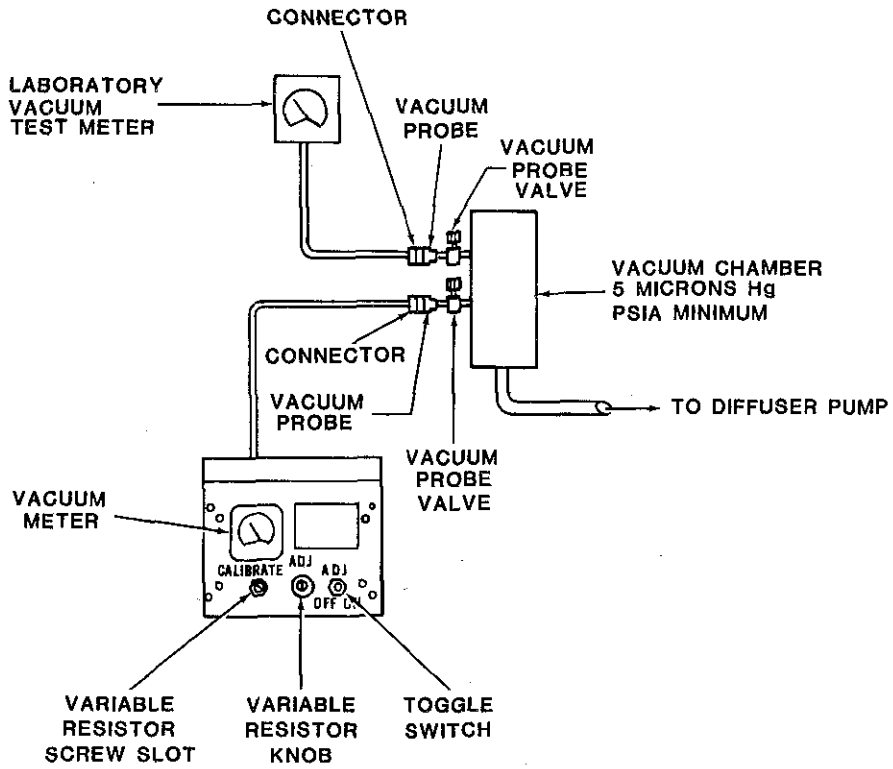
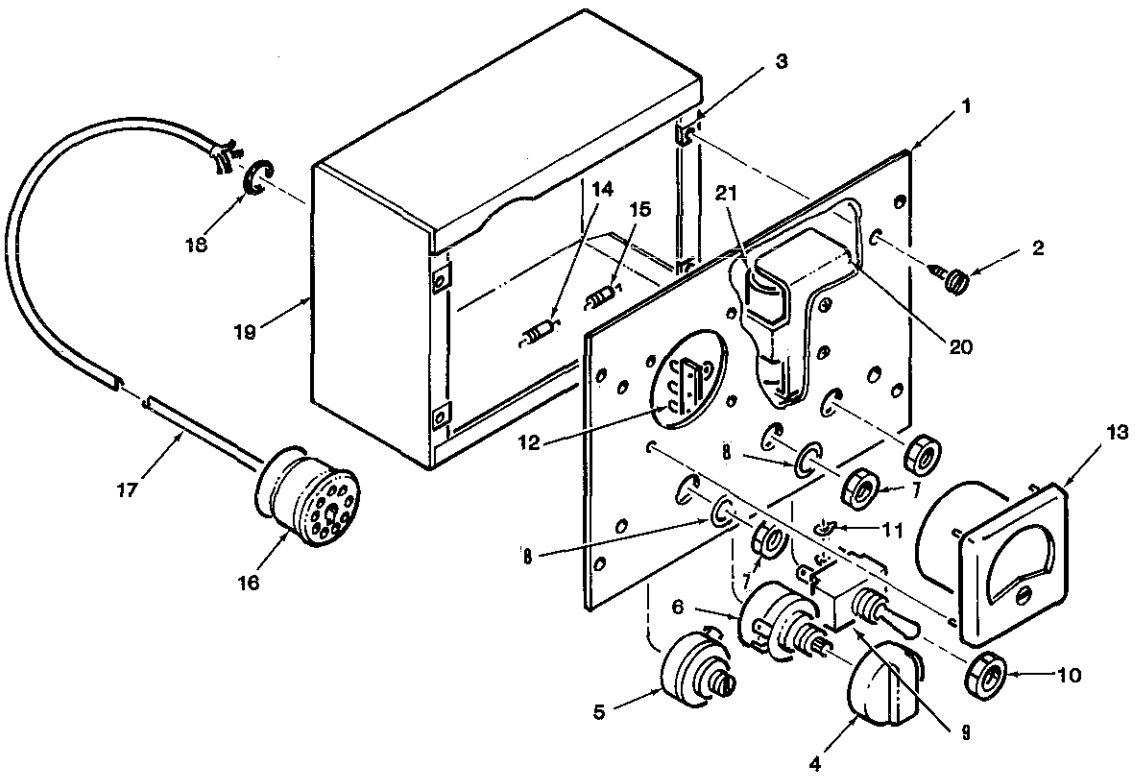


Figure 2. Adjustment Setup



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	2200901-1	INDICATOR, VACUUM/NHA WP 008 00 . 11243/VP3/LOX CLEAN/	REF		PAHHH
1	2200901-3	.PANEL/11243/	1		PAHZZ
		/ATTACHING PARTS/			
2	MS24617-20	.SCREW	4		PAHZZ
3	C7525-8A	.SPEED NUT/78553/	4		PAHZZ
		---*---			
4	1500	.KNOB/12697/	1		PAHZZ
5	A472000	.RESISTOR, VARIABLE/R2/2W, . . 20 OHMS/12697/	1		PAHZZ
6	A43-20	.RESISTOR, VARIABLE/R3/2W, . . 2K OHMS/12697/	1		PAHZZ
		/ATTACHING PARTS/			
7	MS25082-B20	.NUT	2		PAHZZ
8	MS45904-76	.LOCKWASHER	2		PAHZZ
		---*---			

Figure 3. Vacuum Indicator (Sheet 1 of 2)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
9	8834K4	.SWITCH/S1/DPDT/88026/ . . . . . /ATTACHING PARTS/	1		PAHZZ
10	- - -	.NUT/PART OF ITEM 9/ . . . . . ---*---	2		XAHZZ
11	A18-6	.LUG/02929/	6		PAHZZ
12	52	.STRIP, TERMINAL/02929/	1		PAHZZ
13	2601434-1	.METER/M1/11243/	1		PAHZZ
14	RC20GF2222K	.RESISTOR/R4/5W, 2.2K OHM . . . . PLUS/MINUS 10%/81349/	1		PAHZZ
15	RC32GF5R6K	.RESISTOR/R1/1W, 5.6 OHM . . . . . PLUS/MINUS 10%/81349/	1		PAHZZ
16	78-PF8	.CONNECTOR/J1/02660/	1		PAHZZ
17	8444	.CABLE/70903/	1		PAHZZ
18	5	.GROMMET/77969/	1		PAHZZ
19	N002270	.CHASSIS/11243/	1		PAHZZ
20	176	.HOLDER, BATTERY/91833/	1		PAHZZ
21	950	.BATTERY/1.5 VOLTS/83740/	2		PAHZZ

Figure 3. Vacuum Indicator (Sheet 2)

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

VALVES

PART NUMBERS 190406-1, 7115F4S, 1872, 701842X64, 700375X64, 2333B-4PP, 701872X56, 701872X52, 701872X48, 3/8-FRM-2, 2600765-1

This WP supersedes WP 011 00, dated 1 April 1983

Reference Material

None

Alphabetical Index

Record of Applicable Technical Directives

None

1. GENERAL MAINTENANCE.

2. INSPECTION.

a. Inspect all parts for distortion, cracks and damage.

b. Inspect all valves for evidence of leaking.

3. CLEANING.

WARNING

Use cleaning solvent in well-ventilated area. Avoid prolonged breathing of fumes and excessive contact with skin. Keep solvent away from open flames. Use approved safety equipment. Do not direct compressed air at personnel.

CAUTION

Do not use compressed air over 15 psi for blowing parts/components dry.

a. Remove exterior dirt and grease by wiping with cloth dampened with solvent P-D-680.

b. Allow parts to air dry after cleaning.

c. Using compressed air, blow out dirt in cracks, crevices, etc.

4. REPAIR. Repair of the valves is limited to replacement of defective part/component.

5. REPLACEMENT. Replacement of most valve components is possible without removal of entire valve or valve body. Before removal of valve parts/components, drain the tank in accordance with WP 005 00. If valve body replacement is required and valve body is brazed to piping, remove using standard procedures.

6. VACUUM PROBE VALVE (V3). (Figure 1.)

7. DISASSEMBLY.

a. Remove handle (1).

b. Remove retaining ring (2), guide washer (3) and spring (4) from body and bellows assembly (5).

8. ASSEMBLY.

a. Install spring (4) and guide washer (3) on body and bellows assembly (5). Secure with retaining ring (2).

b. Install handle (1).

9. HIGH PRESSURE BLEED VALVE (V10). (Figure 2.)

10. DISASSEMBLY.

a. Remove handle (1) by removing pin (2).

b. Remove mounting nut (3), retaining ring (4) and retainer (5).

c. Remove shims (6, 7), washer (8) and stem (9).

d. Remove end fitting (10). Remove washers (11, 12), retainer (13), seat (14) and ball (15) from body (16).

11. ASSEMBLY.

a. Install washer (12), retainer (13), seat (14), ball (15), seat (14), retainer (13) and washers (12, 11) into body (16). Install end fitting (10).

NOTE

Ball (15) shall be positioned so that slot for stem engagement is in body opening (16).

b. Install stem (9) ensuring that stem engages ball (15) correctly.

c. Install washer (8), shim (7), shim (6), shim (7) and shim (6) into body (16). Install retainer (5).

d. Install retaining ring (4) and mounting nut (3).

e. Install handle (1) and secure with pin (2).

12. FULL TRYCOCK VALVE (V8), LOW PRESSURE BLEED VALVE (V9). (Figure 3.)

13. DISASSEMBLY.

a. Remove nut (1), handwheel (2), packing nut (3), gland (4), packing (5) and bonnet ring (6).

b. Remove bonnet (7), stem (8), disc (9) and seat ring (10) from body (11).

14. ASSEMBLY.

a. Install seat ring (10) into body (11). Install disc (9) and stem (8).

b. Install bonnet (7) and secure with bonnet ring (6).

c. Install packing (5), gland (4) and nut (3).

d. Install handwheel (2) and secure with nut (1).

15. FILL & TRANSFER VALVES (V1, V13. (Figure 4.)

16. DISASSEMBLY.

a. Remove nut (1) and handwheel (2). Remove nuts (3, 6).

NOTE

Parts (7, 8 and 9) are brazed together and removed as an assembly.

b. Remove gland (4) and packing (5). Remove parts (7, 8, 9).

c. Remove stem (10) and disc (11) from body (12).

17. ASSEMBLY.

a. Install disc (11) and stem (10) into body (12).

b. Install parts (7, 8, 9) over stem (10) and secure with nut (6).

c. Install packing (5), gland (4) and nut (3).

d. Install handwheel (2) and secure with nut (1).

18. HIGH PRESSURE GAS DISCHARGE VALVE (CV1). (Figure 5.)

19. DISASSEMBLY.

a. Remove nut (1). Remove seat (2) and spring (3) from housing (7).

b. Remove shroud ring (6) and packing (5) from poppet (4). Discard ring (6) and packing (5).

20. ASSEMBLY.

a. Install packing (5) and shroud ring (6) onto poppet (4). Install poppet into housing (7).

b. Install spring (3) and seat (2) over poppet (4) stem. Secure parts with nut (1).

21. TANK VENT (V4), SERVICING LINE (V2), PRESSURE BUILDUP (V5), PUMP VAPOR RETURN (V6), AND PUMP SUCTION (V12) VALVES. (Figure 6.)

22. DISASSEMBLY.

a. Remove nut (1) and handwheel (2). Remove nut (3), gland (4) and packing (5).

NOTE

Parts (7, 8, 9) are brazed together and removed as an assembly.

b. Remove nut (6). Remove parts (7, 8, 9).

c. Remove stem (12). Remove horseshoe ring (11) and disc locknut (10).

d. Remove disc (13) and seat ring (14) from body (15).

23. ASSEMBLY.

a. Install disc locknut (10) onto stem (12). Install horseshoe ring (11). Install disc locknut (10) into disc (13).

b. Install seat ring (14) and stem (12) into body (15).

c. Install parts (7, 8, 9) over stem (12) and secure with nut (6).

d. Install packing (5), gland (4) and nut (3).

e. Install handwheel (2) and secure with nut (1).

24. VENT LINE PRESSURE REGULATOR (R1). (Figure 7.)

25. DISASSEMBLY.

a. Loosen locknut (1) and remove screw (2). Remove chamber (3).

b. Remove spring button (4), spring (5) and diaphragm stop (6).

c. Remove nut (7) and lockwasher (8). Remove pressure plate (9), diaphragm (10), gaskets (11, 12), disc seat (13) and seat ring (14) from body (15).

d. Do not remove nametag (16) unless replacement is necessary.

26. ASSEMBLY.

a. Install nametag (16) using screws (17). Install seat ring (14), disc seat (13), gaskets (12, 11), diaphragm (10) and pressure plate into body (15). Install lockwasher (8) and nut (7).

b. Install diaphragm stop (6), spring (5) and spring button (4).

c. Install chamber (3) into body (15).

d. Install locknut (1) onto screw (2). Place locknut (1) high enough on screw (2) to allow installation of screw (2) into chamber (3). Install screw (2).

NOTE

Regulator shall be adjusted using screw (2) and locknut (1) to 50 psig. Refer to WP 008 00.

27. EVACUATION VALVE (V11). (Figure 8.)

28. DISASSEMBLY.

a. Remove capseal (1). Loosen setscrew (3) and remove handwheel (2).

b. Remove bonnet (4) by removing nuts (5) and bolts (6).

c. Remove washer (7) and bearing (15). Remove bushing (8).

d. Remove pin (10). Remove spindle (9), compressor (11), plate (12), diaphragm (13) and diaphragm stud (14).

e. Remove lube fitting (16) from bonnet (4) if replacement is necessary.

29. ASSEMBLY.

a. Install diaphragm stud (14). Install diaphragm (13) and plate (12) into body (17).

b. Install spindle (9) into compressor (11) and secure with pin (10).

c. Install compressor (11) into plate (12). Install bushing (8).

d. Install bearing (15) over spindle (9). Install washer (7) over bearing (15).

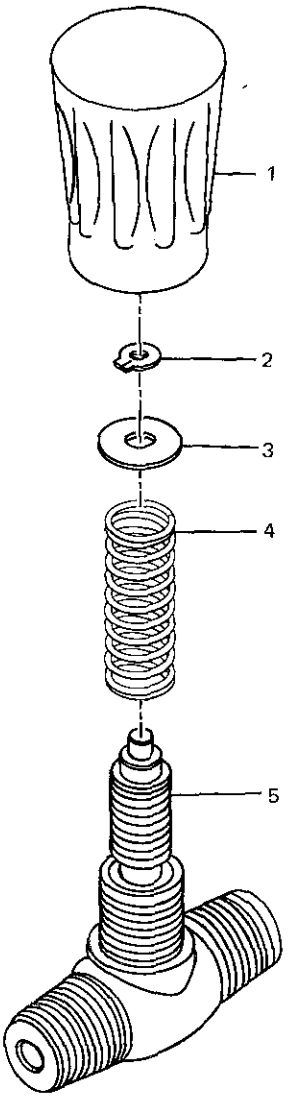
e. Install bonnet (4) over components. Secure bonnet (4) to body (15) using nuts (5) and bolts (6).

f. Install handwheel (2) and tighten setscrews (3). Install capseal (1).

g. Install lube fitting (16) into bonnet (4).

30. ILLUSTRATED PARTS BREAKDOWN.

31. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figures 1 through 8 for illustrated parts breakdown and group assembly parts list (GAPL).



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	190406-1	VALVE/V3/VACUUM PROBE/REFER TO WP 008 00 FOR NHA/	REF		
1	434-44	.HANDLE AND INSERT/28968/	1		
2	5208	.RING, RETAINING/28968/	1		
3	433-7	.WASHER GUIDE/28968/	1		
4	433-5	.SPRING/28968/	1		
5	80117-1	.BODY AND BELLOWS ASSY/28968/	1		

Figure 1. Vacuum Probe Valve

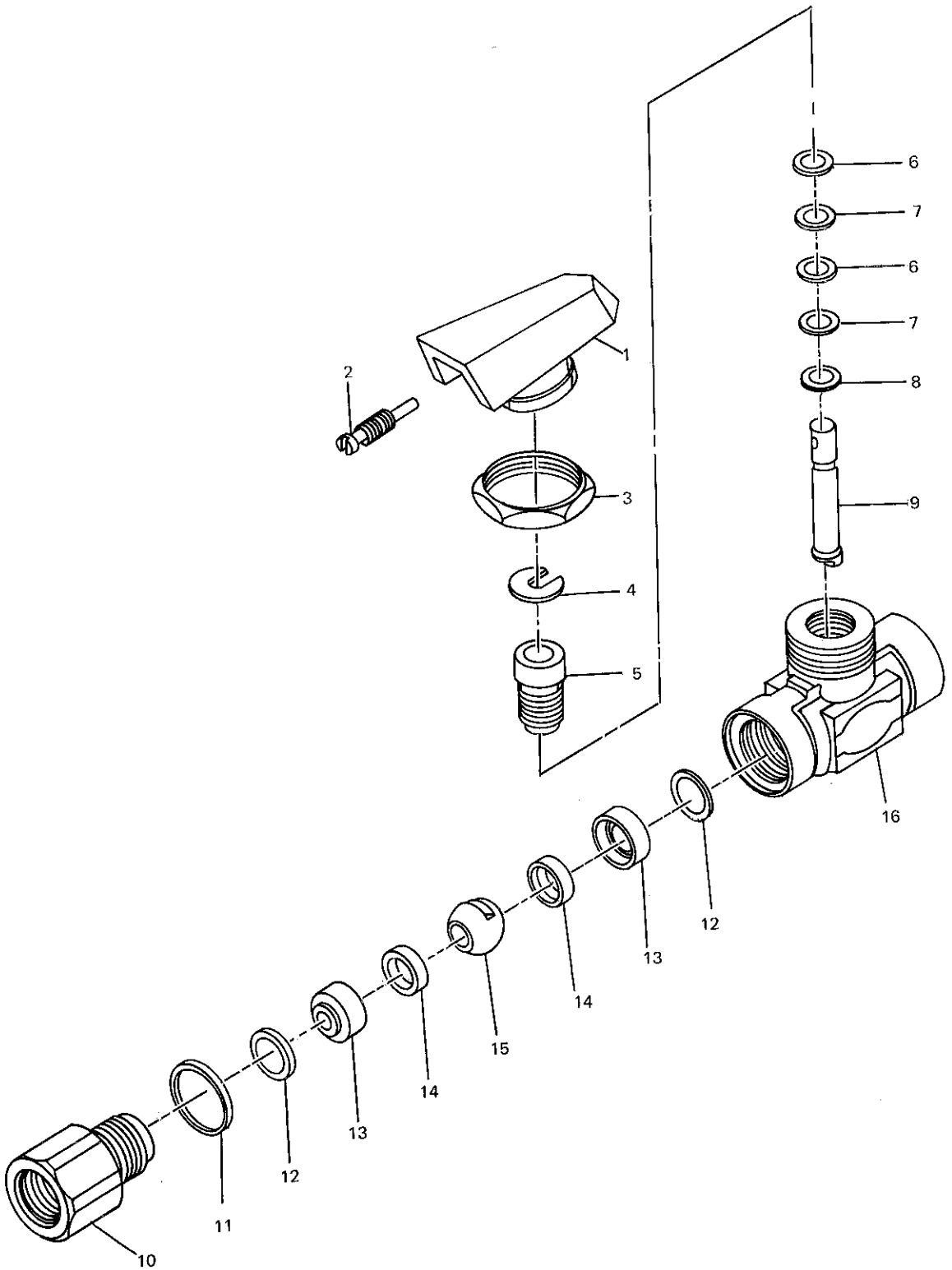
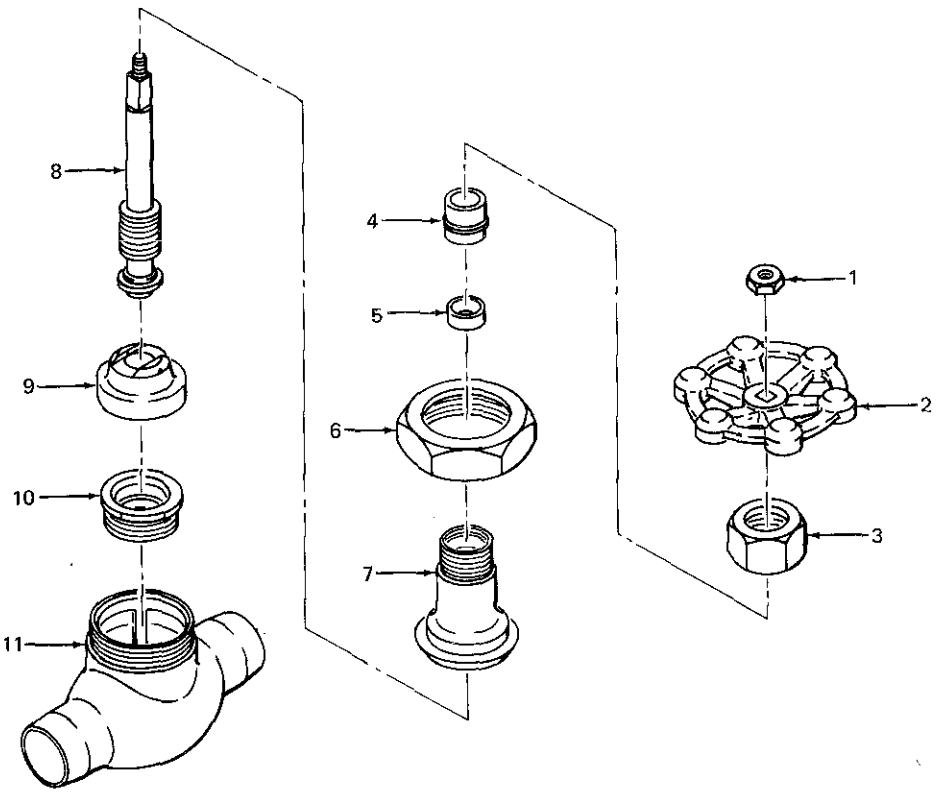


Figure 2. High Pressure Bleed Valve (Sheet 1 of 2)

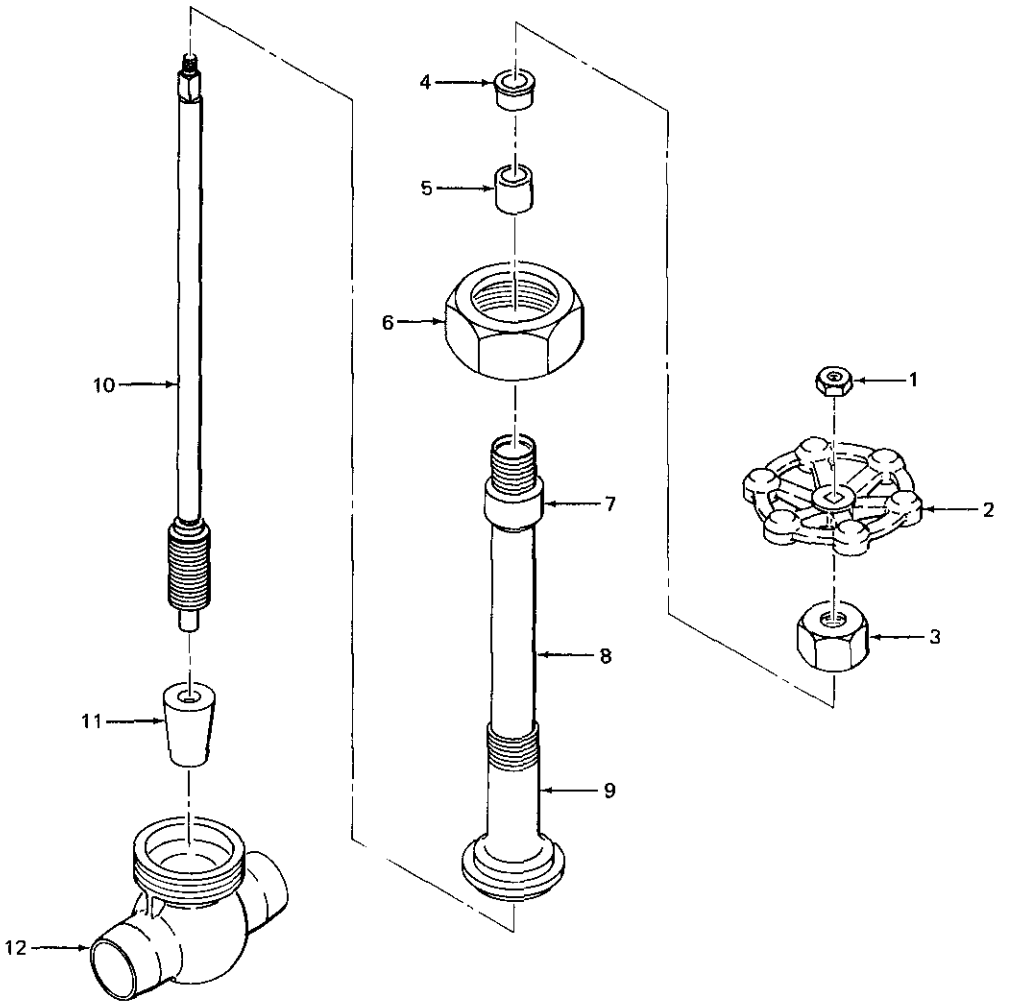
INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	7115F4S	VALVE/V10/HIGH PRESSURE BLEED REFER TO WP 009 00 FOR NHA/	REF		
1	90187-1	.HANDLE/28968/	1		
		/ATTACHING PARTS/			
2	90206-2	.PIN/28968/	1		
		---*---			
3	B492-8BN	.NUT, MOUNTING/28968/	1		
4	5294	.RING, RETAINING/28968/	1		
5	90197-1	.RETAINER/28968/	1		
6	90203-1	.SHIM/28968/	2		
7	90204-1	.SHIM/28968/	2		
8	90324-1	.WASHER/28968/	1		
9	90199-1	.STEM/28968/	1		
10	90194-1	.FITTING, END/28968/	1		
11	90201-1	.WASHER/28968/	1		
12	90327-1	.WASHER/28968/	2		
	80027-1	.RETAINER & SEAT ASSY/28968/	2		
13	90337-1	..RETAINER/28968/	1		
14	90339-1	..SEAT/28968/	1		
15	90200-2	..BALL/28968/	1		
16	90191-1	..BODY/28968/	1		

Figure 2. High Pressure Bleed Valve (Sheet 2)



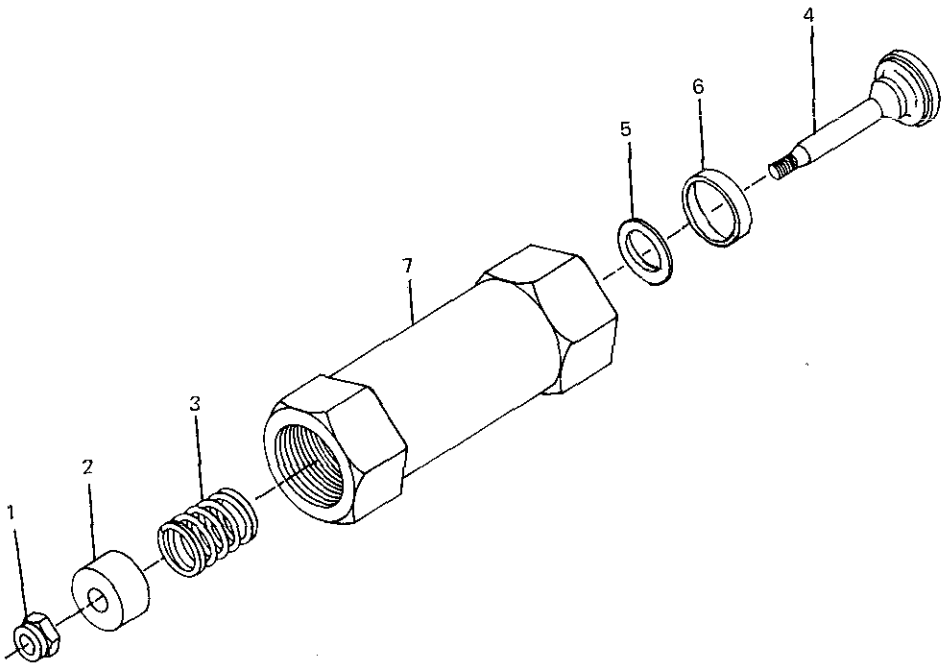
INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	1872	VALVE/V8, V9/FULL TRYCOCK & LOW PRESSURE BLEED/48422/REFER TO WP 008 00 FOR NHA/	REF		
1	F-8653	.NUT/48422/	1		
2	E-25278	.HANDWHEEL/48422/	1		
3	F-33918	.NUT, PACKING/48422/	1		
4	F-63605	.GLAND/48422/	1		
5	F-24748	.PACKING/48422/	1		
6	E-40272	.RING, BONNET/48422/	1		
7	E-63067	.BONNET/48422/	1		
8	F-63070	.STEM/48422/	1		
9	F-40286	.DISC/48422/	1		
10	F-62235	.RING, SEAT/48422/	1		
11	D-61959	.BODY/48422/	1		

Figure 3. Full Trycock and Low Pressure Bleed Valves



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	701842X64	VALVE/V1/FILL AND TRANSFER/48422/ /REFER TO WP 008 00 FOR NHA/	REF	A	
	700375X64	VALVE/V13/FILL/48422/REFER TO WP 008 00 FOR NHA/	REF	B	
1	F-8653	.NUT/48422/	1		
2	E-5151	.HANDWHEEL/48422/	1		
3	F-33919	.NUT, PACKING/48422/	1		
4	F-29986	.GLAND/48422/	1		
5	C-116420	.PACKING/48422/	1		
6	E-40275	.RING, BONNET/48422/	1		
7	F-66385	.SLEEVE/48422/	1		
8	701842X64-8	.TUBE, EXTENSION/48422/	1	A	
	700375X64-8	.TUBE, EXTENSION/48422/	1	B	
9	E-66388	.BONNET/48422/	1		
10	E-66380	.STEM/48422/	1		
11	E-35209	.DISC/48422/	1		
12	D-65994	.BODY/48422/	1	A	
	D-65939	.BODY/48422/	1	B	

Figure 4. Fill and Transfer Valves



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	2333B-4PP	VALVE/CV1/HIGH PRESSURE GAS DISCHARGE CHECK/27409/REFER TO WP 008 00 FOR NHA/	REF	A	
1	6509B	.NUT/27409/	1		
2	10447B	.SEAT/27409/	1		
3	1044B	.SPRING/27409/	1		
4	10446B	.POPPET/27409/	1		
5	4111-33	.O-RING/27409/	1		
6	10423B	.RING, SHROUD/27409/	1		
7	10449B	.HOUSING/27409/	1		

Figure 5. High Pressure Gas Discharge Check Valve

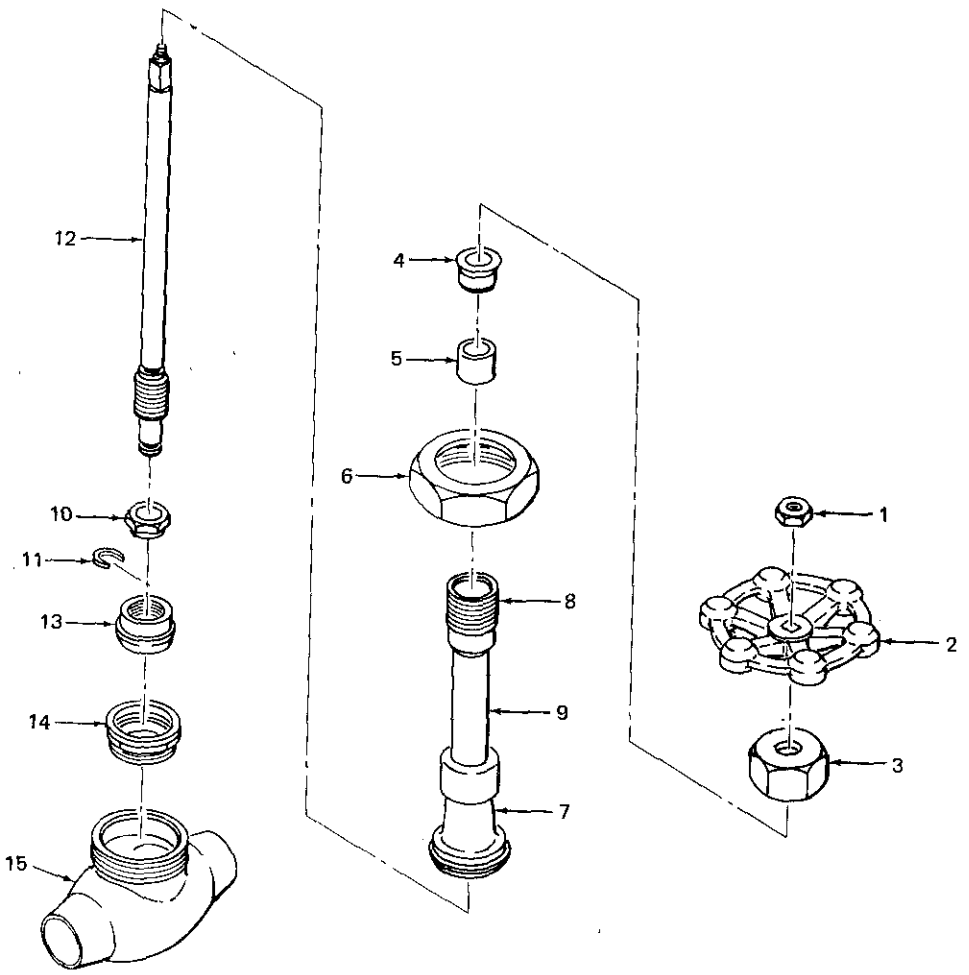
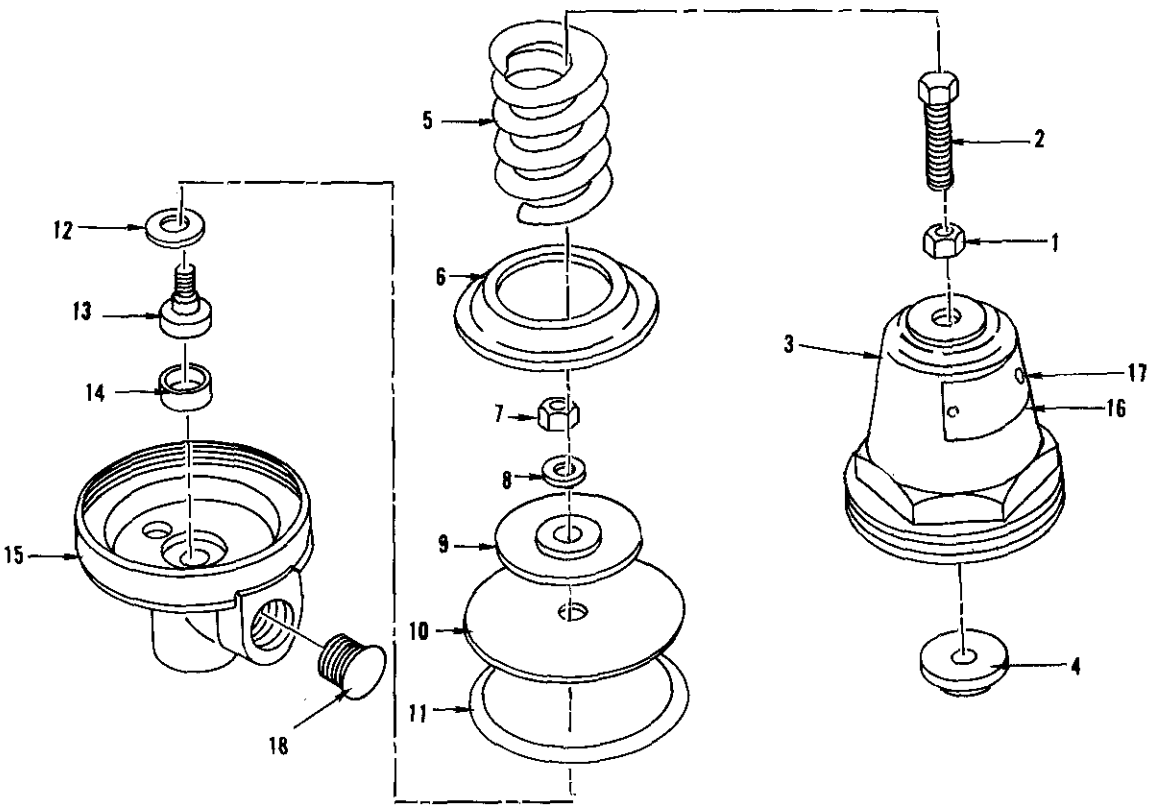


Figure 6. Tank Vent, Servicing Line, Pressure Buildup, Pump Vapor Return and Suction Valves (Sheet 1 of 2)

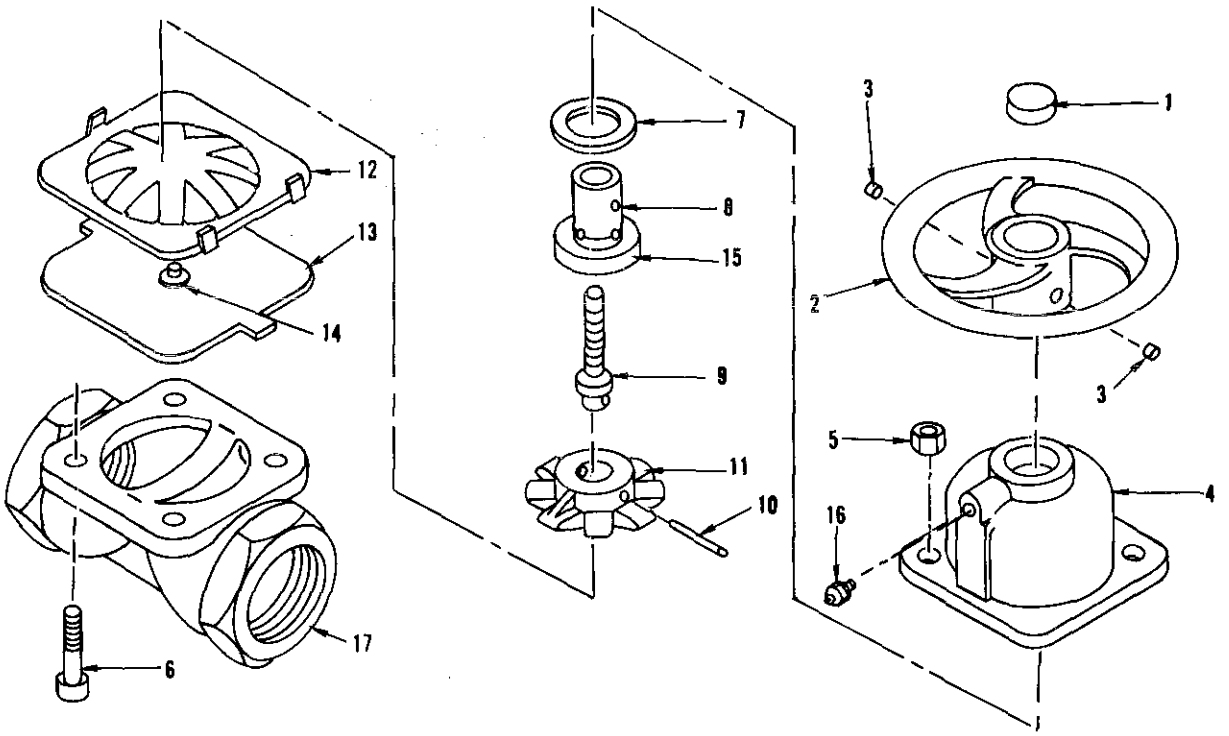
INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	701872X56	VALVE/V4/TANK VENT/48422/ REFER TO WP 008 00 FOR NHA/	REF	A	
	701872X52	VALVE/V2, V5/SERVICING LINE & PRESSURE BUILDUP/48422/REFER TO WP 008 00 FOR NHA/	REF	B	
	701872X48	VALVE/V6, V12/PUMP VAPOR RETURN & SUCTION/48422/REFER TO WP 007 00 FOR NHA/	REF	C	
1	F-8653	.NUT/48422/	1		
2	D-25031	.HANDWHEEL/48422/	1	A	
	E-26375	.HANDWHEEL/48422/	1	B	
	F-5148	.HANDWHEEL/48422/	1	C	
3	F-63230	.NUT, PACKING/48422/	1	A	
	F-33918	.NUT, PACKING/48422/	1	B	
	F-33916	.NUT, PACKING/48422/	1	C	
4	F-63232	.GLAND, PACKING/48422/	1	A	
	F-63605	.GLAND, PACKING/48422/	1	B	
	F-29983	.GLAND, PACKING/48422/	1	C	
5	C-116420	.PACKING/48422/	1		
6	E-40275	.RING, BONNET/48422/	1	A	
	E-40272	.RING, BONNET/48422/	1	B	
	E-40270	.RING, BONNET/48422/	1	C	
7	E-66392	.BONNET/48422/	1	A	
	E-66890	.BONNET/48422/	1	B	
	F-63065	.BONNET/48422/	1	C	
8	F-66584	.PACKING, SLEEVE/48422/	1	A	
	F-66384	.PACKING, SLEEVE/48422/	1	B	
	F-66382	.PACKING, SLEEVE/48422/	1	C	
9	701872X56-8	.TUBE, EXTENSION/48422/	1	A	
	701872X52-8	.TUBE, EXTENSION/48422/	1	B	
	701872X48-8	.TUBE, EXTENSION/48422/	1	C	
10	F-40296	.LOCKNUT, DISC/48422/	1	A	
	F-40293	.LOCKNUT, DISC/48422/	1	B	
	F-40291	.LOCKNUT, DISC/48422/	1	C	
11	F-40303	.RING, HORSESHOE/48422/	1	A	
	F-40300	.RING, HORSESHOE/48422/	1	B	
	F-40298	.RING, HORSESHOE/48422/	1	C	
12	E-64238	.STEM/48422/	1	A	
	F-64235	.STEM/48422/	1	B	
	F-64233	.STEM/48422/	1	C	
13	F-40289	.DISC/48422/	1	A	
	F-40286	.DISC/48422/	1	B	
	F-62429	.DISC/48422/	1	C	
14	E-62238	.RING, SEAT/48422/	1	A	
	F-62235	.RING, SEAT/48422/	1	B	
	F-62233	.RING, SEAT/48422/	1	C	
15	D-61962	.BODY/48422/	1	A	
	D-61959	.BODY/48422/	1	B	
	E-61957	.BODY/48422/	1	C	

Figure 6. Tank Vent, Servicing Line, Pressure Buildup, Pump Vapor Return and Suction Valves (Sheet 2)



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	3/8-FRM-2	VALVE/R1/VENT LINE REGULATOR /71342/REFER TO WP 008 00 FOR NHA/	REF	A	
1	9509	.LOCKNUT/71342/	1		
2	10992	.SCREW/71342/	1		
3	12001	.CHAMBER/711342/	1		
4	8225	.BUTTON, SPRING/71342/	1		
5	8245-1	.SPRING/71342/	1		
6	8243	.STOP, DIAPHRAGM/71342/	1		
7	7999	.NUT/71342/	1		
8	10993	.LOCKWASHER/71342/	1		
9	12094	.PLATE, PRESSURE/71342/	1		
10	2163	.DIAPHRAGM/71342/	1		
11	12003	.GASKET/71342/	1		
12	12002	.GASKET/71342/	1		
13	8230	.SEAT, DISC/71342/	1		
14	8231	.RING, SEAT/71342/	1		
15	8236	.BODY/71342/	1		
16	13399	.TAG, NAME/71342/ /ATTACHING PARTS/	1		
17	12533	.SCREW/71342/ ---*---	2		
18	8184	.CLOSURE/71342/USED FOR STORAGE, SHIPPING/	3		

Figure 7. Vent Line Regulator Valve



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	2600765-1	VALVE/V11/EVACUATION/11243/ REFER TO WP 008 00 FOR NHA/	REF	A	
1	002374	.CAPSEAL/80996/	1		
2	2600765-1-10	.HANDWHEEL/11243/ /ATTACHING PARTS/	1		
3	002577	.SETSCREW/80996/ ---*---	2		
4	2600765-1-6	.BONNET/11243/ /ATTACHING PARTS/	1		
5	2600765-1-4	.NUT/11243/	4		
6	2600765-1-5	.BOLT/11243/ ---*---	4		
7	002677	.WASHER/80996/	1		
8	000813	.BUSHING/80996/	1		
9	000839	.SPINDLE/80996/ /ATTACHING PARTS/	1		
10	002491	.PIN/80996/ ---*---	1		
11	000823	.COMPRESSOR/80996/	1		
12	002504	.PLATE/80996/	1		
13	2600765-1-2	.DIAPHRAGM/80996/	1		
14	002626	.STUD, DIAPHRAGM/80996/	1		
15	002258	.BEARING/80996/	1		
16	002286	.FITTING, LUBE/80996/	1		
17	2600765-1-1	.BODY/80996/	1		

Figure 8. Evacuation Valve

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

MOTOR
PART NUMBER P90A-184T

Reference Material

None

Alphabetical Index

Record of Applicable Technical Directive

None

Support Equipment Required

Nomenclature	Part No.
Grease Gun	- - -

Note

Equivalent substitute items may be used.

Materials Required

Nomenclature	Specification Spec/Part No.
Grease, Polyurea Base Solvent	Chevron, SRI MIL-C-81302

1. DISASSEMBLY. (Figure 1.)

a. Remove nuts (2, 4), shroud (1) and end (3). Remove through bolts (7) and slinger (5). Remove grease fittings (6) if replacement is required.

b. Remove fan (15), slinger (16) and end (17). Remove key (21).

c. Pull rotor (22) out of stator (23) then, remove spring washers (18) and bearings (19, 20).

d. Remove acorn nut (10) and stud (9) to remove conduit box cover (8). Remove screw (12) and ground lug (13). Remove box (14) and gaskets (11).

e. Remove nameplate (24) if replacement is required, by removing screws (25).

2. INSPECTION.

3. Inspect motor and its component parts for evident wear or damage and replace all defective or damaged parts as necessary.

a. Inspect bearings (19, 20) for evidence of overheating.

b. Check that ventilation openings and drain holes are clear and free from dust or dirt.

4. CLEANING.

WARNING

Use cleaning solvent in well-ventilated area. Avoid prolonged breathing of fumes and excessive contact with skin. Keep solvent away from open flames. Use approved safety equipment. Do not direct compressed air at personnel.

CAUTION

Do not use compressed air over 15 psi for blowing parts/ components dry.

5. Remove all grease, oil or dirt from motor parts with cloth moistened with solvent, MIL-C-81302, then wipe dry with dry cloth. Dust may be removed from inaccessible areas using compressed air.

6. ASSEMBLY. (Figure 1.)

a. Lubricate bearings (19, 20) using a good quality rust inhibited polyurea base grease, such as Chevron SRI or equivalent.

b. Install bearing (20) to shaft end of rotor (22) and bearing (19) to blower end of rotor (20). Install key (21).

c. Install rotor (22) into stator (23).

d. Install spring washer (18) onto blower end of rotor (22) then, install end bracket (17), rubber slinger (16) and fan (15).

e. Install fan shroud (1) and end bracket (3), secure in place using through bolts (7) and nuts (2, 4). Tighten nuts (2, 4).

f. Install rubber slinger (5). Install grease fittings (6) if removed. Install nameplate (24) using screws (25).

g. Place inner gasket (11) and conduit box (14) in place on motor. Position conduit knock-out in desired location. Connect ground connection to lug (13) and tighten screw (12).

h. Place outer gasket (11) and cover (8) on conduit box (14) and secure in place using studs (9) and acorn nuts (10).

7. TESTING.

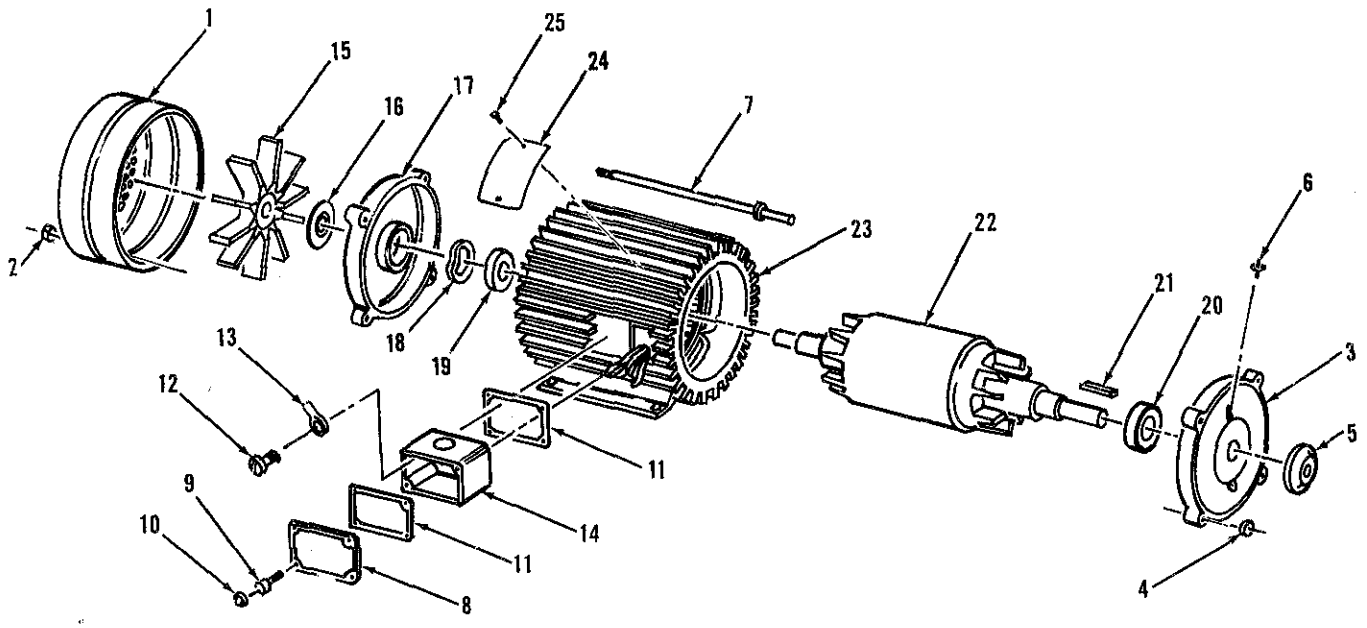
8. After checking that the shaft key (21) is secure, proceed as follows:

a. Turn shaft by hand to make certain that shaft rotates freely without binding.

b. Connect motor leads to appropriate power input voltage (240 or 480 VAC). Operate motor free of load and check for unusual noise or overheating.

9. ILLUSTRATED PARTS BREAKDOWN.

10. Information on vendor codes, attaching parts, source/codes, parts kit and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 1 for illustrated parts breakdown and group assembly parts list (GAPL).



INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	P90A-184T	MOTOR/36232/NHA WP 009 00/M1/ . .	REF		PAHHH
1	P90A-184T-39	.SHROUD/36232/	1		XBHZZ
		/ATTACHING PARTS/			
2	P90A-184T-40	.NUT/36232/	4		XBHZZ
		---*---			
3	P90A-184T-22	.END/36232/	1		XBHZZ
		/ATTACHING PARTS/			
4	P90A-184T-21	.NUT/36232/	4		XBHZZ
		---*---			
5	P90A-184T-26	.SLINGER, RUBBER/36232/	1		XBHZZ
6	P90A-184T-23	.FITTING, GREASE/36232/	2		XBHZZ
7	P90A-184T-30	.BOLT, THROUGH/36232/	4		XBHZZ
8	P90A-184T-47	.COVER, CONDUIT BOX/36232/	1		XBHZZ
		/ATTACHING PARTS/			
9	P90A-184T-48	.STUD/36232/	2		XBHZZ
10	P90A-184T-49	.NUT, ACORN/36232/	2		XBHZZ
		---*---			

Figure 1. Motor (Sheet 1 of 2)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
11	P90A-184T-46	.GASKET/36232/	2		XBHZZ
12	P90A-184T-50	.SCREW/36232/	1		XBHZZ
13	P90A-184T-51	.LUG/36232/	1		XBHZZ
14	P90A-184T-45	.BOX, CONDUIT/36232/	1		XBHZZ
15	P90A-184T-38	.FAN/36232/	1		XBHZZ
16	P90A-184T-37	.SLINGER,RUBBER/36232/	1		XBHZZ
17	P90A-184T-36	.END/36232/	1		XBHZZ
18	P90A-184T-35A	.WASHER, SPRING/36232/	2		PAHZZ
19	P90A-184T-35	.BEARING/36232/	1		PAHZZ
20	P90A-184T-25	.BEARING/36232/	1		PAHZZ
21	P90A-184T-26	.KEY/36232/	1		PAHZZ
22	P90A-184T-29	.ROTOR/36232/	1		XBHZZ
23	P90A-184T-41	.STATOR/36232/	1		XBHZZ
24	P90A-184T-32	.NAMEPLATE/36232/	1		XBHZZ
		/ATTACHING PARTS/			
25	P90A-184T-33	.SCREW, DRIVE/36232/	2		PAHZZ
		---*---			

Figure 1. Motor (Sheet 2)

INTERMEDIATE MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN

CRYOGENIC PUMP
PART NUMBER 2312801-3

Reference Material

Liquid Oxygen Cleaning Requirements MIL-C-52211

Alphabetical Index

Record of Applicable Technical Directives

None

Support Equipment Required

Nomenclature	Part No.
Arbor Press	- - -
Depth Micrometer	- - -

Materials Required

Nomenclature	Spec/Part No.
Asbestos Gloves	- - -
Sandpaper (wet or dry)	No. 400
Grease	KEL-F (3M Company)
Dry Cleaning Solvent	P-D-680
Lockwire	MS20995C32
Molybdenum Disulfide Spray	- - -
Nitrogen, Liquid	- - -

1. DISASSEMBLY. (Figure 3.)

WARNING

Wear asbestos gloves when handling heated pump parts.

CAUTION

Do not allow the weight of the liquid end to rest upon the threaded end of piston (27) at any time during disassembly, shimming or assembly.

a. Remove bolts and washers (25, 24) and work liquid end away from power end approximately 3/4 to 1 inch.

CAUTION

Do not separate more than 1 inch or rear seal ring (28) will expand into the inlet chamber and be sheared off when piston travel is reversed.

b. Rotate shaft (4) until wrench flat on piston (27) is accessible, then unscrew piston from crosshead (19) using thin open-end wrench.

c. Pull liquid end and power end apart, remove shims (42) and thrust washer (41), then remove spacer (40) from crosshead (19).

d. Remove retainer nut (38). Discharge ball (35) will drop out.

e. Remove and discard O-ring (37) from retainer nut (38).

NOTE

If it is necessary to remove and replace the discharge ball guide (36), which is pressed into retainer (38), perform step f., otherwise go to step g.

f. Heat retainer (38) in an oven to 300 to 400°F, then drive ball guide (36) out with drift punch.

g. Drive piston and cylinder (27, 33) out of housing (23) by slipping length of rigid 3/8 inch tubing over threaded end of piston (27) and striking end of tubing with hammer.

h. Gasket (26) will come free with piston and cylinder (27, 33), then pull piston (27) from cylinder (33). Remove rider ring (30) and three sets of expander rings/seal rings (29, 28).

i. Remove O-ring (34) from its seat in housing (23).

CAUTION

Be very careful not to strike piston (27) when removing dowel pins (32). Use a cushioned V-block to support the piston while driving out the dowel pins.

j. Remove inlet ball (31) by removing peening from dowel pin holes with fine triangular file, then drive out dowel pins (32) with drift punch.

k. Remove retainer ring (43) from housing (23). Keep one thumb on secondary seal retainer sleeve (49) as snap ring is removed to keep packing from popping out of housing (23).

1. Remove packing components (44 through 58) from housing (23).

m. Being careful to prevent spring (45) from popping out of sleeve (49), disassemble secondary seal cartridge by removing retainer ring (44) from secondary seal retainer sleeve (49).

NOTE

It is recommended that the following parts be replaced upon disassembly of the liquid end; cold seal (47, 51); O-rings (48, 50); chevron packing (57). Other packing may be reused unless obviously worn or damaged.

2. Disassembly of the power end should not be necessary unless unusual noises are heard, indicating binding or a broken part. If the power end does not rotate, it is usually the result of rusted bearings caused by the pump being inoperative for long period of time. To disassemble the power end, proceed as follows:

a. Remove bolts, washers and nut (13, 14, 15) and pull off bearing cap (11).

NOTE

It may be necessary to slightly warm housing (1) to remove the bearing cap (11).

b. Remove wrist pin (20) by rotating shaft assembly (4) until wrist pin is aligned with notch in housing (1), then remove set screw (22) and slide wrist pin out of crosshead (19).

c. Push crosshead (19) forward and remove from housing (1). Remove retainer assembly (18) and bearing (17). Do not remove insert (21) unless replacement is required.

d. Remove bearing cap (12), bearing shaft assembly (4) and connecting rod (2) by cocking and turning bearing shaft, then lift assembly from housing (1).

e. Remove bushing (3), washer (8), lipseal (9) and retaining ring (10).

NOTE

The bearing shaft assembly (4) is not repairable. If replacement is necessary, remove connecting rod (2) by removing lockwire and then removing screw and washer (6, 5). Warm the connecting rod with a torch and slide it off the bearings.

f. Do not remove inserts (16) unless replacement is necessary.

3. CLEANING.

4. Clean all pump parts in accordance with MIL-C-52211.

5. INSPECTION. (Figure 3.)

6. Inspect liquid end and its associated parts and replace all defective or damaged parts as necessary. Inspect as follows:

NOTE

All critical parts of the liquid end should be inspected for nicks, cracks, scratches, or other damage.

a. Inspect ball guide (36) for scratches or ball seat wear.

b. Inspect cylinder (33) for damaged discharge ball seat and for the presence of scoring or galling.

c. Inspect piston (27) for wear or galling on outer piston surface, for damaged inlet ball seat and for burrs or scratches on packing contact area and wrench flat.

NOTE

Minor scratches or blemishes on the outside diameter of piston (27) may be dressed with No. 400 wet or dry sandpaper.

7. Inspect power end and its associated parts for nicks, cracks, scratches, or other damage. Replace all defective or damaged parts.

8. REPAIR.

9. Repair of the pump is limited to the replacement of defective or damaged component part(s) and/or the installation of kits.

10. It is recommended that the minor overhaul kit be installed at every disassembly of the pump liquid end. Installation of the major overhaul kit should be performed after 1500 operating hours.

11. All O-rings removed should be discarded and replaced. Lubricate new O-rings with KEL-F grease. Apply molybdenum disulfide spray to all stainless steel threads prior to reassembly.

12. The pump features grease-packed sealed bearings, thus eliminating the need for periodic lubrication.

NOTE

Before returning to service the pump must be certified clean for oxygen service.

13. ASSEMBLY. (Figure 3.)

WARNING

Wear asbestos gloves when handling heated pump parts.

a. Install ball guide (36) into retainer (38) and press guide into retainer (38) using arbor press.

b. Set new inlet ball (31) in piston (27).

c. Shrink dowel pins (32) in liquid nitrogen, then press dowel pins into piston (27) using arbor press.

d. Stake dowel pin holes lightly with center punch.

e. Install new rider ring (30) to piston (27) and check for proper fit by forcing piston with installed ring into cylinder (33). Piston should be difficult to push into cylinder, with a minimum of 15 pounds drag caused by rider ring (30).

NOTE

If rider ring is too large to enter cylinder, remove material from the inside diameter of the rider ring (a little at a time) with a small triangular scraper.

f. When rider ring (30) has been fitted, install three new sets of expander rings and seals (29, 28) to piston (27), then push piston into cylinder (33). Compress rings by hand as they enter cylinder to prevent shearing.

g. Install new O-ring (34) into its seat in housing (23), then install gasket (26) in housing (23) and press

cylinder/piston (33, 27) into housing in an arbor press until cylinder seats against gasket (26).

h. Assemble secondary seal cartridge by installing new O-ring (48) on cold seal (47). O-ring should be slightly lubed with KEL-F grease.

i. Push cold seal (47) into secondary seal retainer sleeve (49), followed by spacer (46) and spring (45), then compress spring and secure it in sleeve (49) by installing retainer ring (44).

j. Install new O-ring (50) on retainer sleeve (49). O-ring should be slightly lubed with KEL-F grease.

k. Preassemble secondary seal cartridge and packing components (51 through 58) and slide them over threaded end of piston (27) into housing (23). (See Figure 3 for proper sequence and direction.)

l. Compress packing in arbor press to install retainer ring (43). Use short length of pipe to fit over threaded end of piston (27) and bear against retainer sleeve (49).

m. Install new O-ring (37) into retainer nut (38). O-ring has slightly larger diameter than groove in retainer and should be lightly lubed with KEL-F grease to aid in installation.

n. Install new discharge ball (35) into retainer and screw retainer nut (38) into housing (23). Liquid end is now completely assembled.

o. Install connecting rod (2) on bearing shaft assembly (4) by warming rod (2) in a 300°F oven. Slide rod (2) onto bearing shaft assembly (4). Install bushing (3). Install bearing shaft assembly (4) into housing (1). Install retainers (5) using screws (6). Lockwire screw (6) using MS20995C32 lockwire. (QA)

p. Install inserts (16, 21) if removed. Install bearing (17) and retainer (18) into housing (1). Make certain bearing (17) mates properly with shaft assembly (4). Slide crosshead (19) into housing (1) and align hole with hole in rod (2). Insert wrist pin (20), lightly tap until fully seated. Install setscrew (22).

q. Install retainer ring (10), washer (8) and lipseal (9) onto bearing shaft assembly (4).

r. Warm bearing caps (11, 12) to 200°F. Slide onto bearing shaft assembly (4). Secure with bolts (13), washers (14) and nuts (15).

14. PUMP SHIMMING. (Figure 3.)

15. Shim the pump if any of the following parts are replaced:

Bearing Shaft Assembly (4)
Connecting Rod (2)
Crosshead (19)
Piston (17) or
Cylinder (33)

16. The shims (42) control headspace when the piston is at the most forward position of the discharge stroke (top-dead-center).

17. Desired headspace clearance is 0.010 to 0.014 inch. Proceed as follows:

a. With liquid and power ends completely assembled but separated, force piston (27) into liquid end until it bottoms. Install thrust washer (41) over threaded end of piston.

b. With depth micrometer, measure from pilot boss to thrust washer, and from pilot boss to face of flange. (See Figure 1.) Subtract first measurement obtained from second.

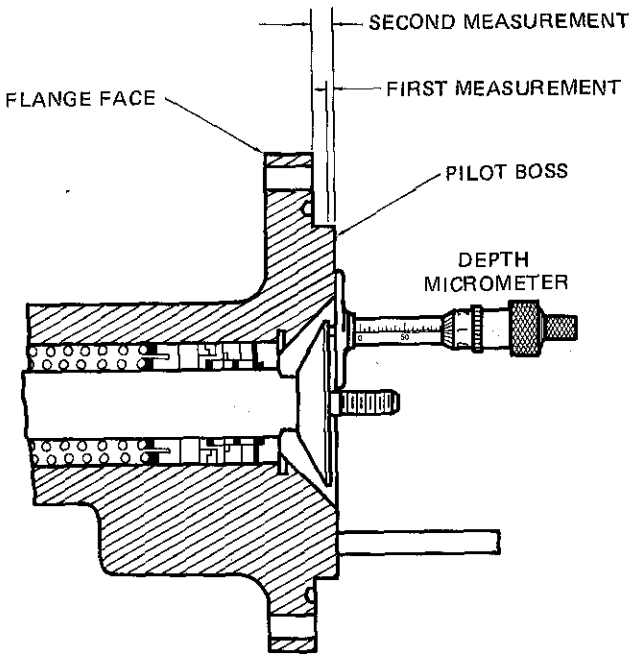


Figure 1. Liquid End Shim Measurement

c. Rotate shaft (4) until crosshead (19) is at top-dead-center, then measure from face of power end housing (1) to crosshead (19). Figure 2 shows key seat position when crosshead is at top-dead center. Subtract result obtained in step b. from this figure.

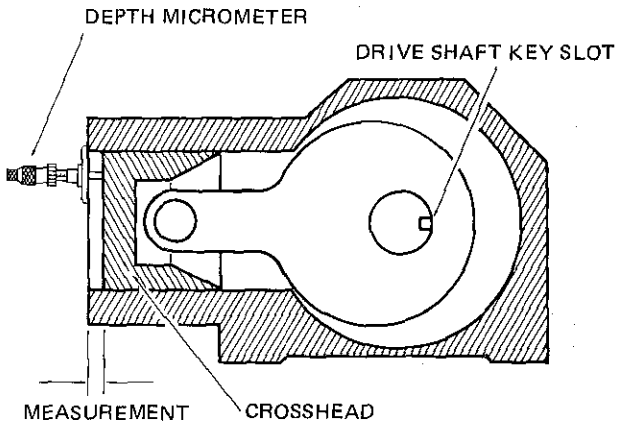


Figure 2. Power End Shim Measurement

d. From result obtained in step c., subtract 0.010 and round off to next lower increment of 0.005. Resulting figure is required shim thickness.

18. Upon completing shimming procedure, assemble the liquid end to the power end. Tighten piston (17) to 50 to 75 inch/pounds. (QA) Install bolts and washers (25, 24).

NOTE

It may be necessary to pry the piston (27) out of liquid end housing to gain access to the wrench flat. This is done with a 1/4-28 nut and an open-end wrench. Be sure to install spacer (40) during assembly.

19. TESTING. (Figure 3.)

20. After assembling the liquid and power ends, rotate shaft (4) through a complete revolution to be sure that piston (27) is not bottoming in cylinder (33). If piston bottoms, the pump has too many shims and must be disassembled and reshimmed.

21. ILLUSTRATED PARTS BREAKDOWN.

22. Information on vendor codes, attaching parts, source/codes, parts kit, and usable on codes is provided in Introduction Work Package (WP 002 00). Refer to Figure 3 for illustrated parts breakdown and group assembly parts list (GAPL).

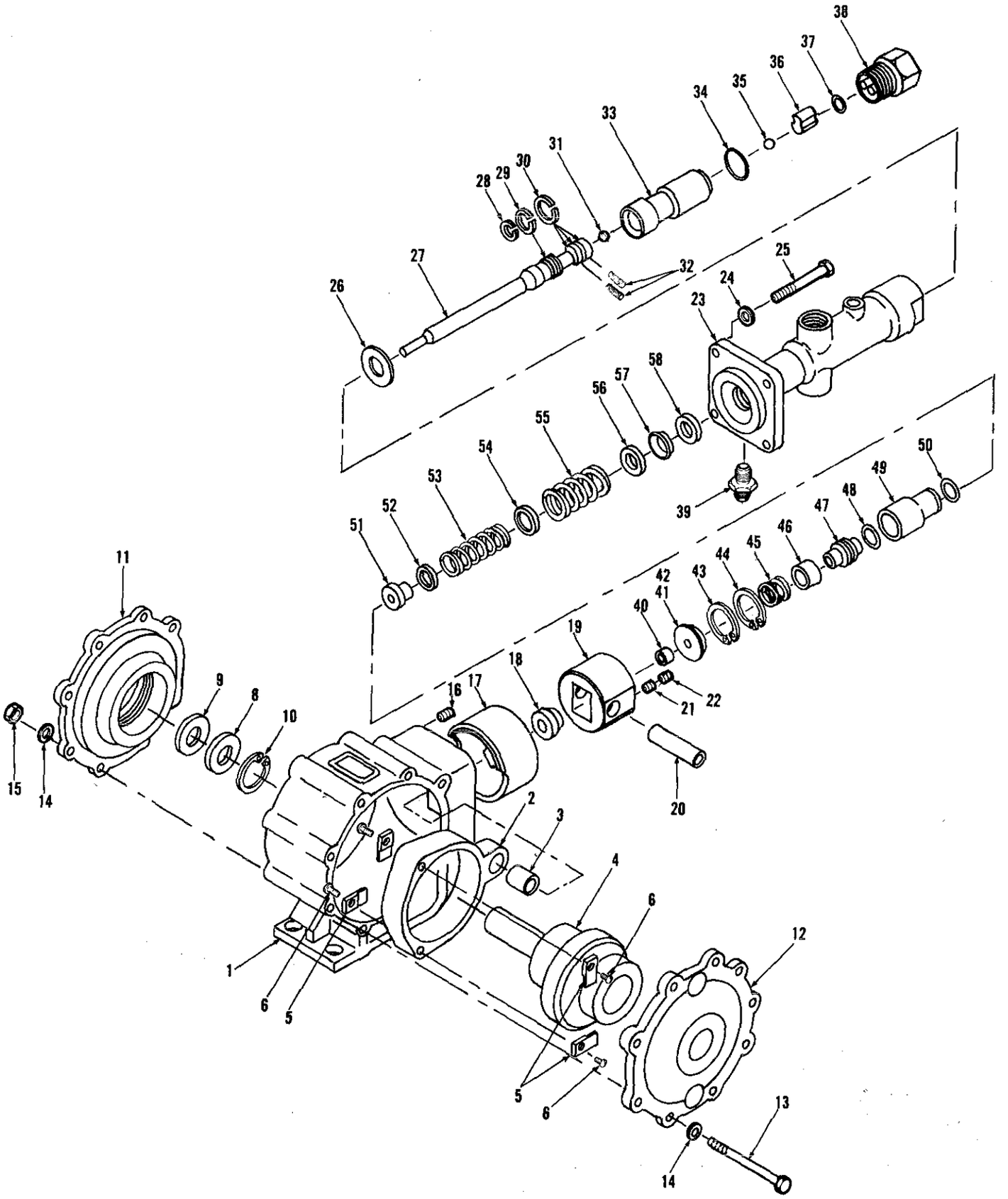


Figure 3. Pump (Sheet 1 of 3)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
	2312801-21	PUMP, CRYOGENIC MODEL CL-1D-75 /NHA WP 009 00/11243/P1/	REF		
1	2312804-1	.HOUSING, POWER END/11243/	1		
2	2312807-1	.CONNECTING ROD/11243/	1		
3	20DU1Z	.BUSHING/26124/	1		
4	2312814-1	.BEARING SHAFT ASSY/11243/ /ATTACHING PARTS/	1		
5	2312811-1	.WASHER	4		
6	MS24693-C7B	.SCREW	4		
		---*---			
7	DELETED				
8	3-2881-3	.WASHER, LIPSEAL/11243/	1		
9	3-2881-3	.LIPSEAL. GREASE/111243/	1		
10	MS16631-225	.RING, RETAINING	1		
11	2312806-1	.CAP, BEARING/11243/	1		
12	2312805-1	.CAP, BEARING/11243/ /ATTACHING PARTS/	1		
13	AN6-56A	.BOLT	8		
14	AN960-616	.WASHER	16		
15	AN365-624	.NUT	8		
		---*---			
16	MS21209-C8-20	.HELICOIL INSERT	4		
17	2312812-1	.BEARING/11243/	1		
18	2312810-1	.RETAINER ASSY/11243/	1		
19	2312808-1	.CROSSHEAD/11243/	1		
20	2312809-1	.WRIST PIN/11243/	1		
21	MS21209-C6-15	.HELICOIL INSERT	1		
22	M70CR616-12	.SETSCREW/72962/	1		
23	2308011-7	.HOUSING, CYLINDER/11243/ /ATTACHING PARTS/	1		
24	AN960-816	.WASHER	4		
25	MS90725-113	.BOLT	4		
		---*---			
26	2300233-5	.GASKET/11243/	1		
27	2308004-1	.PISTON/11243/	1		
28	2300253-1	.SEAL RING/11243/	3		
29	2300229-1	.EXPANDER RING/11243/	3		
30	2308007-1	.RIDER RING/11243/	1		
31	260052-5	.BALL/11243/	1		
32	2308001-19	.DOWEL PIN/11243/	2		
33	2308019-1	.CYLINDER/11243/	1		

Figure 3. Pump (Sheet 2)

INDEX NUMBER	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE	SMR CODE
34	2601425-122	.O-RING/11243/	1		
35	2600052-7	.BALL/11243/	1		
36	2307818-1	.GUIDE/11243/	1		
37	2601425-019	.O-RING/11243/	1		
38	2308020-1	.NUT/11243/	1		
39	2259B-1MM	.CHECK VALVE/14834/	1		
40	2300245-1	.SPACER/11243/	1		
41	2307814-1	.THRUST WASHER/11243/	1		
42	2601279-1	.SHIM/11243/	AR		
43	N5000-106H	.RETAINER, RING/79136/	1		
44	N5008-75H	.RETAINER, RING/79136/	1		
45	C0720-055-0880-S	.SPRING/83553/	1		
46	2312824-1	.SPACER, SECONDARY SEAL/11243/	1		
47	2313009-1	.COLD SEAL/11243/	1		
48	APR568-016	.O-RING/02697/	1		
49	2312825-1	.RETAINER SLEEVE/11243/	1		
50	APR568-020	.O-RING/02697/	1		
51	2304515-1	.COLD SEAL/11243/	1		
52	2304510-1	.RING, INNER LOADING/11243/	1		
53	2304513-1	.SPRING, INNER LOADING/11243/	1		
54	2304511-1	.RING, OUTER LOADING/11243/	1		
55	2304512-1	.SPRING, OUTER LOADING/11243/	1		
56	2300217-3	.BUSING/11243/	1		
57	2600121-1	.CHEVRON PACKING/11243/	1		
58	2300227-1	.BUSHING/11243/	1		
	2312822-1	KIT, MINOR OVERHAUL/CONSISTS OF ITEMS 28, 29, 30, 31, 32, 34, 35, 37, 42, 47, 48, 50, 51, 56, 57, 58/11243/	REF		
	2312823-1	KIT, MAJOR OVERHAUL/CONSISTS OF ITEMS 8, 9, 10, 27, 33, 36, 43, 44, 45, 46, 49, 52, 53, 54, 55/11243/	REF		

Figure 3. Pump (Sheet 3)

☆ U.S. Government Printing Office: 1987—711-005/40136